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# The Retirement Behaviour of the Self-employed in Britain



**Abstract**

We analyse the retirement behaviour of older self-employed workers, using a life cycle framework and a multinomial logit model of dynamic employment and retirement choices. Using data from the two-wave Retirement Survey, we find that greater actual or potential earnings decrease the probability of retirement among the self-employed. In contrast to employees, none of gender, health or family circumstances appear to affect self-employed retirement decisions. The dynamic analysis reveals that relatively few employees and virtually no retirees switch into self-employment in later life. The switches that do occur are motivated less by attempts to use self-employment as a bridge job or 'stepping stone' to full retirement, than by self-employment being a last resort for less affluent workers with job histories of weak attachment to the labour market. We compare self-employed and employee retirement behaviour, and discuss the policy implications of our results.

# 1 Introduction

This paper asks what determines the retirement behaviour of older self-employed workers, and analyses the dynamic process of occupational and retirement choices in later life. Specifically, we search for the factors that explain when the self-employed retire, who chooses to become and remain self-employed in later life, and differences in self-employed retirement behaviour compared with employees.

There are several reasons why this topic may be of interest to academics and policy-makers. First, while retirement among employees has been heavily researched in the academic literature, relatively little is known about the retirement behaviour of the self-employed.[1] Yet the self-employed face different institutional restrictions on retirement and possibly also different incentives to retire, having higher labour force participation rates and lower retirement rates than employees.[2] This makes self-employment a potentially interesting occupational choice to policy-makers concerned about falling labour force participation rates, ageing populations, and the prospect of substantial future publicly-funded pension liabilities (Disney, 2000; Bovenberg, 2003). It raises the prospect that schemes to promote self-employment among older workers might fulfil twin objectives: of increasing overall labour force participation rates among older workers while stimulating the economy to become more competitive and entrepreneurial (OECD, 2000).

Clearly a better understanding of self-employed retirement behaviour is needed before one can begin to sketch the outlines of possible self-employment schemes for older workers. In particular, we require evidence about whether lower self-employed retirement rates relative to employees can be explained in terms of different preferences for leisure relative to work; different incentives; or different institutional structures. Re-

[1] For studies on employee retirement, see Stock and Wise (1990a, 1990b), Berkovic and Stern (1991), Lumsdaine *et al* (1992), Blau (1994, 1998), Ruhm (1996), Rust and Phelan (1997), Samwick (1998), Friedberg (1999, 2003), Gustman and Steinmeier (2000a, 2000b, 2001), Baker (2002) and Blundell *et al* (2002). In contrast, we know of few studies of the labour market behaviour of older self-employed workers, chiefly the US studies of Quinn (1980), Fuchs (1982), and Bruce *et al* (2000).

[2] For example, while only about one tenth of the overall workforce is self-employed in the US and UK, about one third of the workforce over 65 in each country is self-employed – a proportion that has been relatively stable over time (Iams, 1987; Moralee, 1988; Bruce *et al*, 2000).

garding institutions, for example, the self-employed do not usually receive employer- or government-provided sickness leave or benefits. Instead they have to provide their own pension and health-care coverage, which suggests that life cycle saving might be an integral aspect of self-employed behaviour. At the same time, self-employed workers in Britain do not face a mandatory retirement age, unlike employees. Their incentives might also differ from those of employees. In particular, the self-employed do not face the problem of timing their separation from a firm in order to maximise the value of occupational pension rights. In contrast, this problem is of primary importance for employees with occupational pension plans where it has spawned several rich models, including ones based on option value (Stock and Wise, 1990a, 1990b) and dynamic programming (Rust and Phelan, 1997) approaches. These models may be less appropriate for the self-employed, in part because they abstract from non-pension asset accumulation in order to focus on endogenous switches in and out of pension schemes; and also because the self-employed do not face incentive problems embodied in occupational pen plans, relying instead on personal savings to finance their retirement behaviour. For this reason, we use a life cycle approach to model self-employed retirement behaviour.

It turns out that the life cycle model used in this paper can shed some light on the determinants of self-employed retirement behaviour. We estimate the model using data from the two-wave British *Retirement Survey* — the best micro-data source currently available in Britain. Because the self-employed are a minority of the workforce, the *Retirement Survey* yields only a relatively small sample size (just under 200); nevertheless, it is still possible to generate some interesting new findings. Among these, we find that the determinants of self-employed retirement differ from those impacting on employee retirement — an important point which any policy intervention should take account of. We supplement this analysis by briefly exploring dynamic occupational and retirement choices in later life, obtaining evidence about the characteristics and subsequent retirement behaviour of older workers who switch into self-employment. These are presumably the individuals that any self-employment scheme for older workers is likely to attract; and we discuss the implications of our findings for policies attempting to promote self-employment via such schemes. To anticipate our findings, we suggest that the most effective way to encourage older workers to become and remain self-employed is to 'catch them when they are young', as most switchers into self-employment in later life retire shortly thereafter. Also, advances in health care that help keep older workers active appear to be a key aspect of any government initiatives to promote labour force participation and self-employment among older workers. Specially, older employees in poor health are more likely to retire, and less likely to switch into self-employment.

The paper proceeds as follows. Section 2 outlines a simple model of retirement based on the life cycle hypothesis, together with its stochastic representation, and suggestions for extensions to take account of possible sample selection bias in the presence of unobserved heterogeneity and endogenous occupational choice. Section 3 describes the data set, and the measurement of the explanatory variables. Section 4 presents and interprets the results. This comprises a static analysis of retirement decisions, a dynamic analysis of transitions between different employment states over the two waves of the Survey, and a sensitivity analysis. Section 5 discusses the policy implications of our results, while Section 6 concludes.

# 2 The model

## 2.1 The optimisation problem

The problem facing a specific agent aged $t$ who plans to retire at age $R$ and live until age $T$ is

$$\max_{c(\cdot)} U = \left\{ \int_t^R \exp\{-\delta(s-t)\}\, u(c(s),0)\, ds + \int_R^T \exp\{-\delta(s-t)\}\, u(c(s),1)\, ds \right\}$$
$$\text{subject to} \quad \int_t^T \exp\{-r(s-t)\}\, c(s)\, ds = \Omega(R)$$

where $c(\cdot)$ is consumption through time, $u(\cdot,\cdot)$ is an 'instananeous' utility function defined on consumption and retirement status respectively, $\delta$ and $r$ are discount and interest rates, respectively, and $\Omega(R)$ is current total lifetime wealth, which is a function of retirement age. Lifetime wealth is the value of financial, business and housing assets plus the present value of all state pension (social security), personal pension and labour incomes that an individual commands over the remainder of their life. Its annuity stream is commonly referred to as permanent income.

We can solve this problem for the optimal consumption path $c^*(\cdot, R)$ treating $R$ as parametric, and substitute the result back into the maximand to give the indirect utility function, $U^*(R)$. Then we can maximise the indirect utility function over $R$ to identify the optimal retirement age. Here we acknowledge that a key feature of being self-employed is control over the retirement age. Using the envelope theorem gives

$$\frac{dU^*}{dR} = -\exp\left\{-\delta(R-t)\right\}\nabla(c^*(t), R) + \lambda^*\frac{d\Omega}{dR} \tag{1}$$

where $\nabla(c^*(t), R) := u(c^*(t), 1) - u(c^*(t), 0)$ is utility in retirement relative to work, and $\lambda^* := dU^*/d\Omega \geq 0$ is the marginal utility of wealth. We would usually expect that $\nabla(c^*(t), R) > 0$, i.e. the same amount of consumption is more enjoyable when combined with leisure time (i.e. in retirement). Because of earnings opportunities in work, we would also expect that $d\Omega/dR > 0$, i.e. deferring retirement by one period enhances the current stock of lifetime wealth by the amount of extra income generated in that period.

The meaning of (1) is straightforward. The marginal utility of postponing the retirement age $R$ by a period involves foregoing utility from leisure – with a negative impact – but this is compensated by greater present and future consumption possibilities afforded by greater lifetime wealth, which has a positive impact.

In order to analyse the determinants of an individual's current retirement status, consider an individual who is considering retiring. By setting $R = t$ in $U^*$ they can examine the utility that follows from retiring immediately. Whether or not immediate retirement is beneficial is given by the sign of the derivative of $U^*$ with respect to $R$, namely

$$\left.\frac{\partial U^*}{dR}\right|_{R=t} = -\nabla(c^*(t), t) + \lambda^* \, \Omega_R \tag{2}$$

where $\Omega_R := d\Omega/dR$ at $R = t$. For the reasons given above, both terms in (2) are likely to be positive, and so there will be individuals for whom it is beneficial to retire (negative sign) and others for whom it is beneficial to continue to work (positive sign). Consequently it seems reasonable to model the probability that the individual is retired at age $t$ as some monotonic increasing function of the negative of (2), written as

$$\pi^* = \mathsf{Pr}\big[R \le t\big] = F(v^*) \qquad \text{where} \quad v^* = -\left.\frac{\partial U^*}{dR}\right|_{R=t} \tag{3}$$

where $F(\cdot)$ is called the 'conditional mean function' in standard econometrics terminology (Greene, 2003). We call this the 'retirement equation'.

## 2.2 A statistical framework across individuals

For any individual we can observe retirement status, $I_{R<t}$, where $I_p$ is the indicator function of the proposition $p$. We can also observe a number of covariates that distinguish individuals from one another, $x$ say. These covariates are associated with the level of $v^*$ through $\nabla\big(c^*(t), t\big)$. We might write

$$v^* \approx f(x) - \lambda^* \, \Omega_R \, ,$$

where $f$ is an unknown function which depends upon the unknown utility function (taken to be a function of $x$), and $\Omega_R = d\Omega/dR$. Note the importance of an appropriate specification of the vector $x$. It should capture person-specific preferences relating to the work-leisure trade-off, to facilitate identification of any *preference* for retirement (i.e., $f(x)$) separately from the *incentives* for retirement, given by $\lambda^* \, \Omega_R$.

The incentive $\Omega_R$ can be measured directly if earnings from an extra period of work are observed or imputed, as we explain in the next section. Note that $\Omega_R$

(which is henceforth called the 'accrual') is not necessarily 0 for retired individuals. From the way in which we have solved the problem, the accrual is "the incremental change in my lifetime wealth were I currently to be working and decided not to retire immediately but to defer for a small amount of time". It is true that this value may be easier to compute for those currently working, but it is also clear that those who have retired and can return to employment ought also to be making a calculation of this kind.

So far $\lambda^*$ has been taken to be a constant, capturing the size of any 'substitution' effect in retirement behaviour. More generally, we can allow for the possibility of diminishing marginal utility of lifetime wealth by writing $\lambda^* = \lambda^*(\Omega) = \lambda_0 - \lambda_1\Omega$, where $\lambda_0 > 0$, $\lambda_1 \geq 0$ subject to $\lambda^*(\Omega) \geq 0$. Then $\lambda_1$ captures specifically any 'income' effect in retirement behaviour. In our empirical application, $\Omega$ can be measured directly from micro data, while the sign of $\lambda^*$ can be checked in the results.

For the statistical treatment of this model, our data comprise the $n$ tuples $(\pi_i, x_i, \Omega_i, \Omega_{Ri})$, where $\pi_i$ is the indicator function of retirement for individual $i$. We assume that these tuples are exchangeable. We use the probit function for $F$ and write $\pi_i^* := \Phi(v_i^*)$, where $\Phi(\cdot)$ is the standard normal distribution function. Using linear functionals for $f$ as well as $\lambda^*$, our empirical model is

$$v_i^* = \alpha_1 + x_i^T\gamma_1 - (\lambda_0 - \lambda_1\Omega_i)\Omega_{Ri} + \epsilon_{i1} \tag{4}$$

where $\epsilon_{i1}$ is an uncorrelated gaussian error term. The parameter vector $\theta := (\alpha_1, \gamma_1, \lambda_0, \lambda_1)$ can be estimated by maximising a standard probit log likelihood function associated with (4). A testable prediction of the life-cycle model is that the accrual has a negative effect, and lifetime wealth a zero or positive effect, on the probability that a given individual is retired. Note that the life cycle model suggests that lifetime wealth enters the retirement equation interactively rather than separately. The logic is that the Lagrange multiplier $\lambda^*$ maps the accrual into retirement behaviour, since $\lambda^*$ is the marginal utility of lifetime wealth. Allowing $\lambda^*$ to depend on lifetime wealth then gives rise to the interaction term in (4). Later we will test whether our empirical results are sensitive to this aspect of the model specification.

An important question is whether there is unobservable heterogeneity with respect to retirement status. Do the self-employed differ from employees in their retirement behaviour in ways that cannot be captured by our covariates? Specifically, might there be unobservable variables that drive both retirement behaviour and the likelihood of being self-employed? For example, perhaps very energetic individuals who enjoy work and are therefore reluctant to retire are more likely to become self-employed. To answer this question, we extend our statistical framework in the following way.

Consider the following probit 'selection' equation:

$$s_i^* = \alpha_2 + y_i^T \gamma_2 + \epsilon_{i2}\,, \tag{5}$$

where $i$ is self-employed ($s_i = 1$) if $s_i^* \geq 0$, and is an employee ($s_i = 0$) if $s_i^* < 0$; where $y_i$ is a vector of individual characteristics that bear on the occupational choice decision, $y_i \neq x_i$ in general; and where $\epsilon_{i2}$ is an uncorrelated gaussian error term, such that $\epsilon_{i1}, \epsilon_{i2} \sim \mathrm{BVN}(0, 0, 1, 1, \rho)$. The key point is that $(\pi_i, x_i,\, \Omega_i, \Omega_{Ri})$ is only observed for $i$ if $s_i = 1$. The log-likelihood function for this model is

$$\begin{aligned} \ln L(\Theta) \;=\; & \sum_{i=1}^{n} \big\{ \pi_i s_i \ln \Phi_2\big(\alpha_1 + x_i^T \gamma_1 - (\lambda_0 - \lambda_1 \Omega_i)\Omega_{Ri}, \alpha_2 + y_i^T \gamma_2, \rho\big) \\ & \quad + s_i(1-\pi_i) \ln \Phi_2\big(-\alpha_1 - x_i^T \gamma_1 + (\lambda_0 - \lambda_1 \Omega_i)\Omega_{Ri}, \alpha_2 + y_i^T \gamma_2, -\rho\big) \\ & \qquad - (1-s_i) \ln \Phi\big(-\alpha_2 - y_i^T \gamma_2\big) \big\}\,, \end{aligned} \tag{6}$$

where $\Phi_2(\cdot,\cdot,\cdot)$ denotes the bivariate normal distribution function. After estimating the parameters $\Theta := (\theta, \alpha_2, \gamma_2, \rho)$ by maximising (6), one can check for sample selection by testing the hypothesis that $\rho = 0$. Thus controlling for sample selection complements the observable heterogeneity in work-leisure preferences characterised by $f(x)$, with unobservable heterogeneity in these preferences.

# 3 Data set and methodology

## 3.1 The *Retirement Survey* data set

We estimated the model outlined in the previous section using data from the British *Retirement Survey* (RS). The RS is a rich two-wave data set containing individual- and household-level information on personal and financial characteristics, health and labour market behaviour around the time of retirement. The first wave contains information from interviews conducted in 1988/89 with 3543 respondents who were aged between 55 and 69, together with 609 spouses outside this age range. The second wave took place in 1994, which involved re-interviewing about two thirds of the original respondents and spouses in a single face-to-face survey. The other one third of respondents either did not respond to the second interview or had died between the two waves. Data from both waves are used in the current paper, with an emphasis on explaining retirement behaviour and occupational choices in the second wave.

An individual is defined as self-employed in the RS if their most recent job was in self-employment rather than paid employment. Of the total sample, complete information was available for 197 self-employed individuals.[3] This is a smaller sample than is often used for studying employee retirement behaviour, reflecting the fact that only a minority of the workforce is self-employed. It is also smaller than samples on self-employed workers that have been drawn from the US *Retirement History Survey*, including those of Fuchs (1982) ($n = 443$) and Quinn (1980) ($n = 836$). The limitations of using a relatively small sample size should therefore be borne in mind when the empirical results are discussed.

The RS contains several alternative definitions of retirement. One is a broad definition, whereby an individual is retired if they consider themselves to be so. Self-

[3] Of the 1994 sample, 282 individuals were self-employed, of whom 85 were omitted because there was incomplete information about one or more component of their lifetime wealth (see below). The omitted individuals did not appear to have different observable characteristics to those remaining in the sample.

reported definitions of this kind may be criticised on the grounds that some individuals misclassify themselves. For example, it can be objected that some of the 'self-employed' respondents are not actually self-employed at all, but are claiming self-employment status (e.g., 'consultancy') to justify retirement to their peers. We will therefore also utilise in our empirical work an additional, narrower, definition of retirement. To be defined as retired under this definition, an individual must be out of work and not seeking work, and must cite being retired as the main reason for not working.[4]

To give some idea of the difference between the measures, some 64% of the sample are retired on the broad definition, compared with 59% on the narrow definition. The proportion retired on the broad definition compares with 81% of all individuals in the 1994 RS (Tanner, 1998). This reflects the greater tendency of the self-employed compared with employees to work beyond the statutory retirement age, a well-known 'stylised fact' in the UK (Tanner, 1997) and US (Quinn, 1980; Fuchs, 1982; Sickles and Taubman, 1986; Bruce *et al*, 2000). Indeed, according to the 1994 RS, 73% of the self-employed in 1994 worked beyond the statutory employee retirement age of 65 for men and 60 for women.

The RS also enables the researcher to compute lifetime wealth $\Omega$, and the accrual, $\Omega_R$. We next discuss issues involved in measuring these two variables, before describing the other explanatory variables used in the empirical work.

## 3.2 Explanatory variables: Lifetime wealth and accrual

Because the computation of lifetime wealth imposes considerable demands on micro data, most previous studies have tended to consider the effects of just a subset of its components on retirement.[5] In contrast, the RS enables a comprehensive measure

[4]Several other retirement definitions have also been used in the literature, including ones based on a discontinuous drop in wages or hours worked (Gustman and Steinmeier, 1984; Burtless and Moffitt, 1985), or whether individuals receive low or zero wages (Honig and Hanoch, 1985). Information on work hours is unavailable in the RS, ruling out use of the first definition; and many self-employed report zero incomes (Parker, 1997) making the second definition problematic.

[5]For example, Diamond and Hausman (1984), Honig and Hanoch (1985) and Burtless (1986) considered only financial wealth. Samwick (1998) also included private and state (social security)

of lifetime wealth to be computed, encompassing many of those recommended in the literature (see, e.g. Wolff, 1987; Zagorsky 1999). As well as housing and financial wealth, it is also possible to calculate capitalised values of state pension, private and occupational pension entitlements; future expected earnings; and expected future business resale values. The RS contains detailed data on all of these sources of lifetime wealth, which is computed at the individual level.

To save space, we give only a broad outline of the construction of lifetime wealth (see Parker, 2003, for a fuller explanation). Information about house values and mortgage debts outstanding in 1994 was used to calculate net housing wealth. Because of the wide coverage of financial assets in the RS, a comprehensive measure of financial wealth was straightforward to compute from the 1994 data. More work was required to compute state, private and occupational pension wealth. Fortunately, the RS contains a wealth of information across the two waves that make relatively refined estimates possible. This includes detailed information about income indexation formulae and other rules and provisions of each individual pension scheme. Also, observed pension incomes in the first wave enabled pension entitlements in the second wave to be estimated for individuals with incomplete pension records, by matching individuals with missing data in wave 2 to cases with observed data in both waves. The longitudinal nature of the RS, and its detailed file of job history data, also enables the researcher to infer current and future earnings of those working and the imputed values of those no longer working (see below for further details). Recalling that lifetime wealth measures one's control over total current *and future* resources, earnings wealth was estimated by applying average actual income growth rates to actual or imputed 1994 incomes until the expected age of retirement (see below). Finally, business wealth was computed from responses to the RS question about the expected value of businesses and the expected sale date. In the computation of the lifetime wealth

pension wealth; the latter alone was used by Gordon and Blinder (1980), McCarty (1990) and Reimers and Honig (1996). Pension wealth also appears in Mitchell and Fields (1984), who additionally used the NPV of labour market incomes ('earnings wealth'). Hogarth (1988) used just earnings wealth. See Hurd (1990) for a discussion of all of these sources of lifetime wealth. Many more authors analyse only single-period income flows, from investments, pensions and earnings, without accounting for future values of these flows.

components, all future income flows were capitalised using a discount rate of 3%; and individual-specific life expectancy tables were used in the capitalisation calculations.

[INSERT TABLE 1 AROUND HERE]

Because the composition of lifetime wealth might be of independent interest, Table 1 summarises the holdings of each component, as well as the aggregate value, and the accrual variable (see below) for our self-employed sample. Despite some limitations — including the common use of banded data from which point estimates are imputed, and the small number of respondents claiming business wealth[6] — the RS has the advantage of containing comprehensive data on current wealth and future entitlements. Also, its sample wealth component distributions match those published in national accounts data (Disney *et al*, 1997). We would suggest however that earnings wealth should be treated with some caution because 1994 earnings were uprated to estimate post-1994 values by using the observed average self-employment income growth rate, obtained from National Accounts data. The use of a common rather than an individual-specific income growth rate estimated between the waves was motivated by the different macroeconomic conditions prevailing after 1994 (high growth) compared with 1988/89–94 (recession and low growth). While this is likely to avoid the use of inappropriate growth rates, it is however also likely to understate the true variability of earnings within the sample. Note also that if the self-employed under-report their incomes (Pissarides and Weber, 1989), the effect of this cannot be easily removed from the present value calculation.

Despite these limitations, we felt it appropriate to retain earnings wealth in the analysis. As pointed out by Baker *et al* (2003), lifetime earnings might capture heterogeneity in work preferences and so assist with identification in the cross-sectional analysis.

Turning next to the accrual, recall that this is defined as the incremental value from deferring retirement for another period. For the self-employed, earnings are the

[6] The small proportion of respondents claiming any business wealth in Table 1 may reflect the fact that many self-employed workers are in occupations like construction, trades and crafts, sales, and vehicle maintenance in which there are virtually no tangible assets to sell. This seems to account for the preponderance of missing values for business wealth in the raw RS data.

only component of lifetime wealth that is *directly* affected by such a deferral. This is because neither early retirement provisions in occupational pensions nor SERPS entitlements are relevant for the self-employed; private pension annuities are invariant to the retirement date; financial and housing wealth are not directly affected by retirement; and the present value of the state (social security) pension in Britain is designed to be approximately invariant to the retirement age.[7]

A practical difficulty is imputing 1994 earnings, $e_{i94}$, for individuals for whom no earnings were observed in 1994. Imputation involved estimating earnings growth rates, $g_{i94}$, conditioned on a vector of explanatory variables observed in 1988/89, denoted by $h_{i88}$. By the properties of the lognormal distribution (treating this as a convenient approximation to the distribution of earnings),

$$g_{i94} = \ln e_{i94} - \ln e_{i88} = h_{i88}^T \beta + \omega_{i94} \tag{7}$$

$$\Rightarrow \quad \mathsf{E}(e_{i94}) = e_{i88}.\exp\left(h_{i88}^T \hat{\beta} + \hat{\sigma}_\omega^2/2\right), \tag{8}$$

where $\omega_{i94} \sim N\left(0, \sigma_\omega^2\right)$ is a stochastic disturbance and $\beta$ is a vector of coefficients.[8] In order to impute earnings as accurately as possible, a general-to-specific regression search was used to compute $\hat{\beta}$. The appendix contains details of the regression results. Results are also given for employees, which are used later for comparative purposes.

The bottom two rows of Table 1 disaggregate the accrual for retired and non-retired respondents. These data indicate that the accrual distribution for non-retirees first order stochastically dominates that of retirees. Checks revealed that this is not merely an artefact of our imputation procedure, as very similar results were obtained when actual earnings of non-retirees in 1994 were replaced with their imputed values

[7] To be sure, one can think of indirect effects on resources from deferral of retirement, e.g., if individuals move house when they retire, so that fluctuations in house prices become relevant. But most individuals do not move house at the same time as they retire. Similarly, businesses are not necessarily sold at the time of retirement and realised as an accrual, e.g., because some family businesses are bequeathed to successors. As noted above, only 4% of self-employed respondents in the RS held any net business wealth in any case.

[8] This imputation procedure enjoys an advantage over that of Meghir and Whitehouse (1997) by exploiting the 1988/89 wave of the RS, which was unavailable to those authors. Clearly, it is very problematic to impute 1994 earnings for those individuals without recorded earnings even in 1988/89, something we therefore do not attempt.

and comparisons were made with imputed earnings of retirees. Thus the different accrual values seem to reflect genuine differences in earnings opportunities.

### 3.3 Other explanatory variables

Several non-pecuniary variables, $x$, are likely to affect preferences for leisure relative to work, and thereby the probability of retirement, $\pi^*$. One such variable is age, which is expected to increase the marginal value of leisure, as the remaining time to enjoy it diminishes. On the other hand, cohort effects might confound this prediction, e.g., if older cohorts work harder than their younger counterparts. To allow for a non-linear effect in retirement-age patterns, the age data were represented by an orthogonal basis of degree two. The use of orthogonal polynomials is necessary because the limited range of the age data would result in strong collinearity if simply 'age' and 'age$^2$' were used. Therefore we transform the data onto orthogonal linear and quadratic scales. For our sample the transformations are

$$\begin{aligned} \psi_1(x) &= -0.8850 + 0.0133\,x \\ \psi_2(x) &= 5.3681 - 0.1650\,x + 0.0013\,x^2 \end{aligned} \tag{9}$$

which have the usual properties that

$$\begin{gathered} \sum_{i=1}^{n} \psi_1(x_i) = \sum_{i=1}^{n} \psi_2(x_i) = \sum_{i=1}^{n} \psi_1(x_i)\,\psi_2(x_i) = 0 \\ \sum_{i=1}^{n} \{\psi_1(x_i)\}^2 = \sum_{i=1}^{n} \{\psi_2(x_i)\}^2 = 1 \end{gathered} \tag{10}$$

when $x_i$ is the age of individual $i$ in the sample of size $n$.

An aspect of ageing that is of special interest in the present study is the bridge retirement process, whereby employees may choose self-employment as a 'stepping stone' to full retirement. We investigate this issue by checking whether the 'long term' self-employed have different retirement patterns compared with employees who switched into self-employment fairly recently. For this reason, a dummy variable for whether the individual was self-employed in the first wave of the RS (i.e., in 1988/89) is also included.[9] In our sample 57.9% were defined as long-term self-employed according to this definition.

A consideration that often arises when analysing behaviour of older workers is health. An individual's own poor health, or that of a relative they look after, might reduce their ability to run a business, and increase the value of spending time away from work. Poor health is measured using two variables. One is a weighted score (on a scale from 0 to 21) of 13 different disabilities relating to inability to undertake essential tasks, termed Activities of Daily Living (see Grundy and Glaser, 1997, for details). The second is a dummy variable for whether the individual is classified as disabled, where disability is defined as "any restriction or lack (resulting from an impairment) of ability to perform an activity in the manner or within the range considered normal for a human being."[10] In our sample 40% were classified as disabled, and the mean poor health score was 1.91.[11] A dummy variable is also defined for whether individuals care for a sick relative, since this might increase the relative disutility of work relative to leisure, the latter including time spent in the caring capacity. Carers comprised 5.6% of the sample.

Other relevant family-level variables are the number of children living in the household (the mean number in the sample was 2.31), and whether the individual was married (82.7% were). As above, these variables might be expected to increase the desire for leisure (retirement) relative to continued work. Finally, a family-level dummy variable that is expected to work in the other direction is whether the individual's spouse is working (see Blau, 1998). Although we do not explicitly consider issues of joint

[9] See also Blau (1994), who stresses the importance of job history variables. While work status six years previously might not give a precise idea of 'long term' work status in the 'conventional' (i.e., employee) sense, the low survival rates of small businesses suggests that this interpretation is not untenable for the self-employed. It will be seen below that this variable is indeed an informative discriminator among the self-employed.

[10] These health measures are based on self-assessed information. Self-reported health measures have been criticised in the literature because people can blame being out of the labour force on poor health (Parsons, 1982). But Bound (1991) points out that self-reported measures may be no worse than 'objective' measures.

[11] The relatively large number of disabled respondents might either reflect the more dangerous working conditions of the self-employed (as observed by OECD, 2000), or an institutional bias against employees with disabilities.

retirement in this paper,[12] if leisure is a joint household good, then having a working spouse might be expected to reduce the individual's surplus of post-retirement utility over pre-retirement utility, so decreasing the probability of retirement. In fact, it is unclear whether joint retirement should be more or less important for the self-employed relative to employees. On one hand, the self-employed have more variable incomes than employees do, and so can be expected to benefit more from household income smoothing derived from spousal income. Hence the retirement of a previously working spouse might yield an extra incentive for a self-employed person to retire, as the benefit from income smoothing is removed. On the other hand, if older self-employed workers are less well off on average than their employee counterparts (see below), then retirement of a spouse might make it all the more important that the self-employed person continues to work in order to safeguard household income.

Several other explanatory variables are also included in the econometric specification. One is a dummy for female gender (comprising 30% of the sample) which can be used to isolate any differences in preferences between the sexes in self-employed retirement behaviour. Two others were the number of years of schooling (the sample mean was 10.3), and a dummy variable for whether the individual had acquired vocational qualifications (19.3% of the sample had). Both of these variables might capture non-pecuniary aspects of jobs that make retirement relatively more or less attractive to continued work. So might social class, which is inferred in the RS from details about an individual's current or most recent occupation, narrowly defined. It is measured on an ordinal scale from 0 to 5, with 0 being the 'lowest' class. This was re-coded as five dummy variables to allow for the possibility of a non-monotonic or non-linear response to social class. In our sample 48.1% belonged to one of the top two social classes.

[12]See, e.g., Hurd (1990), Zweimuller *et al* (1996), Gustman and Steinmeier (2000b) and Baker (2002). It seems justified not to model joint retirement explicitly in the present context because, as pointed out by Tanner (1997), *"the clear majority of couples* [in the RS] *do not retire at the same time."* (p. 48).

# 4 Estimation and Results

This section is divided into three parts. In the first, we estimate the static retirement equation (4), discuss the results, and compare them with those obtained for an employee sample taken from the RS. We also address issues of sample selection here. In the second part, we provide a dynamic analysis of retirement behaviour around the time of retirement, exploring the transitions between self-employment, employment, and retirement over the two waves of the RS. The third part contains a sensitivity analysis, to provide some checks on the robustness of the results.



## 4.1 Static analysis of retirement

We first estimated (4) by maximum likelihood. Table 2 contains the results for both broad (columns 1a and 1b) and narrow (columns 2a and 2b) definitions of retirement. All of the regressions presented in Table 2 are highly significant and data congruent, with good hit rates and insignificant Hosmer-Lemeshow statistics.[13]

Columns 1a and 2a measure both substitution (accrual) and income (accrual times lifetime wealth) effects. The latter are insignificantly different from zero, implying that $\lambda_1 \approx 0$. This suggests that the marginal utility of lifetime wealth is approximately constant for the self-employed, so that retirement and lifetime wealth are not strongly linked (see also Gustman and Steinmeier, 2001; and Blundell *et al*, 2002, for similar findings based on reduced form studies of employees). Imposing this restriction yields the results in columns 1b and 2b, in which the accrual now has a significant negative effect on retirement decisions. This result is in accordance with the life cycle model, implying that greater actual or potential earnings (the substitution effect) delay retirement. These findings are consistent with those of Meghir and Whitehouse (1997), who found using RS data that higher imputed earnings tend to delay job exits among employees.[14]

[13] All estimations were performed using LIMDEP 8.0, using robust standard errors derived from a sandwich-style covariance matrix estimator. See the notes to Table 2 and Greene (2002, 2003) for further details about these probit model performance measures.

[14] The reason for the significance of $\Omega_R$ once $\Omega_R\Omega$ is dropped is partly explained by the high

[INSERT TABLE 2 AROUND HERE]

Apart from the accrual, only two other explanatory variables are consistently significant for both definitions of retirement. One is age, which has a strong positive effect on retirement probabilities as expected, suggesting that the marginal utility of leisure relative to work increases as self-employed individuals get older. The other is long term self-employment status, suggesting that the long-term self-employed have a lower probability of retirement at every age. Two other explanatory variables are statistically significant using the narrower definition of retirement. These are age squared, which has a negative effect implying that the impact of age on retirement diminishes with age, and having a working spouse. The latter provides some limited support for the notion that retirement is a joint decision for couples.

Why do comparatively recent entrants to self-employment have a higher tendency to retire soon afterwards? One possibility is that some former employees purposefully choose self-employment as a bridge job, or form of partial retirement, as a stepping stone to full retirement (Quinn, 1980). Another possibility is that these employees are marginal or peripheral workers who are pushed into self-employment as a last resort. In an attempt to discriminate between these two explanations, we examined the detailed inter-wave job history files that accompany the RS. Table 3 presents summary statistics that distinguish between the 'long term' self-employed (i.e., who were self-employed in both waves), and the Wave 2 self-employees who were employees in Wave 1. We call the latter 'switchers'. The results suggest that switchers have a significantly and substantially greater incidence of part-time jobs and jobless spells between the waves than the long-term self-employed do. They also have significantly and substantially lower wealth and actual or potential earnings; are older on average; and have a higher unconditional probability of retirement. This suggests (tentatively given the relatively small sample sizes) that switchers have a relatively weak attachment to the labour market with less secure job matches, drifting in and out of temporary and part-time work of several kinds, including self-employment.

correlation coefficient of 0.838 between the two variables. Therefore our preferred results are columns 1b and 2b, which remove this source of collinearity.

While part-time work is not inconsistent with the notion of bridge jobs (Fuchs, 1982), the fact that switchers have so many more short-term jobs and are worse off than the long-term self-employed suggests that some 'push' factors are present too. Switchers certainly cannot be characterised as affluent employees who are voluntarily downsizing their jobs as a prelude to full retirement. In short, new self-employment jobs among older British workers seem to be less a form of partial retirement than a concerted effort by vulnerable workers to remain active in the workforce.

[INSERT TABLE 3 AROUND HERE]

There is also some weak evidence from Table 3 that switchers have somewhat worse health than the long term self-employed. They are also more likely to be female. But, as is evident from Table 2, neither health nor gender exerts a significant impact on the retirement decision in 1994 once long-term self-employment status is controlled for. This finding contrasts with previous evidence for employees.[15] It also contrasts with our own findings based on a sample of employees taken from the RS (the fact that this is also a relatively small sample might suggest that sample sizes are not driving the self-employed results). Table 4 replicates for our RS sample of employees the specifications reported in columns 1b and 2b of Table 2. The results from this exercise will be discussed more fully below; for now, it suffices to observe that among *employees*, females and those with worse health are significantly more likely to retire. For the self-employed, however, these results suggest that preferences are similar across genders, even while incentives differ (self-employed females have significantly lower accruals than self-employed males). Second, regarding health, it is possible that the self-employed are used to working when they are ill, as a consequence of their inability to access employer sick pay or sickness insurance schemes (Perry and Rosen, 2004). And, the flexibility of self-employment might provide workers with ways of circumventing any physical limitations they face. Of course, these are only tentative hypotheses, and further research based on larger samples or more detailed case studies

[15] For US evidence, see Burkhauser (1979), Gordon and Blinder (1980), Hogarth (1988), Berkovec and Stern (1991) and Samwick (1998). For UK evidence see Meghir and Whitehouse (1997). Siddiqui (1997) provides German evidence.

is needed to dig deeper into the underlying causes of the phenomenon. Nevertheless, it seems possible to conclude that institutional differences might explain why employee retirement behaviour is more sensitive to gender, health, and age.[16] Female employees have an earlier mandatory retirement age than males; early retirement schemes within corporations can enable employers to remove workers who take excessive sick leave; and there are binding mandatory retirement age limits. None of these provisions apply to the self-employed.

[INSERT TABLE 4 AROUND HERE]

Comparing columns 1b and 2b of Table 2 with columns 3 and 4 of Table 4 reveals other differences in the determinants of retirement between employed and self-employed Britons. Neither employment status in 1988/89 nor the accrual are significant for employees whereas they are for the self-employed.[17] And some aspects of family structure appear to matter more for employees than for the self-employed. In particular, the presence of children and a working spouse appear to decrease the likelihood that employees will retire, while these variables are less important for the self-employed.

Finally, we consider what the results so far tell us about why the self-employed retire later on average than employees do. The evidence points strongly to long-term self-employment status as a central part of the answer. In particular, if we remove the long-term self-employed from the self-employed sample, the proportion of the self-employed 'switchers' from employment in 1988/89 who are retired under the

[16] Note that the age-retirement relationship is approximately linear for employees, without a significant diminishing effect as was found for the self-employed in Table 2; and the size of the coefficients on linear age for employees are approximately double those estimated for the self-employed.

[17] Note, however, that the 'accrual' in Table 4 should really be regarded simply as actual or imputed earnings for employees. (They were calculated in the same way as for the self-employed – see the last columns of Table A1 in the appendix.) A true accrual for employees should also include the value of occupational rights conditional on the date of retirement (Blundell *et al*, 2002). Therefore the results in Table 4 afford an illustrative comparison only, and are certainly not intended as a definitive model of employee retirement – a task that goes beyond the scope of the present article (see Meghir and Whitehouse, 1997; Blundell *et al*, 2002; Bingley and Lanot, 2004). Even so, accrual values are higher for employees than for the self-employed: the absolute t-statistic for differences in $\ln(1 + \Omega_R)$ between the two occupations is 6.239. Even allowing for income under-reporting by the self-employed of 30% (Pissarides and Weber, 1989) does not change this result, merely reducing the t-statistic to 4.675. As noted above, part of the reason for earlier retirement by employees no doubt reflects incentives for early retirement embodied in occupational pension schemes (Disney *et al*, 1994), which we do not attempt to quantify here.

broad definition is 83%: a very similar proportion to that of employees (see Table 3 and Section 3, respectively). In contrast, the proportion of long-term self-employed who are retired is only 50% (Table 3). This is where the root of the difference between paid employment and self-employment retirement rates seems to lie. It appears to have little to do with unobserved heterogeneity of the self-employed (sample selection), since estimation of (6) yielded $\hat{\rho} = 0.036$ (standard error = 3.063).[18] So while these findings cannot definitively exclude the possibility of unobservable heterogeneity, they certainly provide no support for the notion that people who select into self-employment are systematically different with respect to latent preferences for work relative to retirement.

## 4.2 Dynamic analysis of retirement

The two-wave nature of the RS makes it possible to analyse transitions between three labour market states: working in self-employment, working in paid employment, and being retired. An analysis of this issue is helpful because it sheds light on the dynamics of retirement, and puts the results for the self-employed into a broader perspective.

One can identify the factors that determine transitions between the two waves of the panel by generalising the binary choice model (5) into a three-state multinomial logit:

$$\mathsf{Pr}\big[s_{i94} = j\big] = \frac{\exp\{y_{i88}^T \delta_j\}}{\sum_{m=0}^{2} \exp\{y_{i88}^T \delta_m\}} \qquad j = 0, 1, 2\,, \tag{11}$$

where

$$s_{i94} := \begin{cases} 0 \quad \mathsf{if} \quad i \quad \text{is retired by 1994} \\ 1 \quad \mathsf{if} \quad i \quad \text{is working as an employee by 1994} \\ 2 \quad \mathsf{if} \quad i \quad \text{is working as self-employed by 1994} \end{cases}$$

The $\delta_j$ are vectors of coefficients for each employment group $j$, and $y_{i88}$ is a vector

[18] In estimating (6) by FIML, the $y$ variables used in the selection equation (5) include all of those used in (4), but measured at 1988/89 (rather than at 1994) values. Complete results are available from the authors on request.

of explanatory variables observed in 1988/89. Following conventional practice, we identify the parameters of this model by imposing the vector normalisation $\delta_0 = 0$.

Table 5 presents the matrix of transitions between each employment group. It shows that the largest number of transitions is from any kind of work to retirement. One quarter of the working self-employed in 1994 came from retirement or paid employment in 1988/89, while there were very few transitions from self-employment to paid employment between the waves. However, only 3.6% [=12/331] of working employees in 1988/89 who continued to work in 1994 switched to self-employment over the 5 year interval — a lower switching rate than reported in previous US studies.[19] Detailed examination of the job history files identified a further 24 employees in Wave 1 who tried self-employment at some time between the two waves but who were retired by 1994. Thus while there is some evidence of transitions between employment groups generally, and into self-employment specifically, the numbers involved appear to be fairly modest.

[INSERT TABLES 5 & 6 AROUND HERE]

To explore the matter further, we estimated (11) using data from both waves of the RS. We utilised a similar specification to that used elsewhere in the paper, apart from excluding a working spouse variable (unavailable in 1988/89), and including dummies for employment status in Wave 1. The results appear in Table 6. Even after controlling for observable characteristics, most of the explanatory power comes from strong persistence in occupational choices. Interestingly, Table 6 indicates a negative effect from poor health on participation in self-employment (but not paid employment), suggesting that unhealthy respondents in Wave 1 prefer to retire than to switch into self-employment later in life. In contrast, as we found earlier, poor health does not appear to hasten retirement among those who have already chosen self-employment.

[19] Fuchs (1982) and Bruce *et al* (2000) each reported a *two-year* switching rate of 4%.

### 4.3 Sensitivity analysis

It is desirable to check the robustness of our results. We did so in several ways. First, we tried an alternative specification of the retirement probit in which the interaction term $\Omega_R\Omega$ was replaced by $\Omega$, thereby conditioning $\pi_i^*$ on $\Omega_R$ and $\Omega$ separately (as in, e.g., Blundell *et al*, 2002). The results were very similar to those reported in Table 2, with the coefficient on $\Omega$ still being statistically insignificant.

Second, we checked the sensitivity of our results to different accrual imputation methods. For example, we applied a common (average) self-employment earnings-growth rate to all respondents with observed Wave 1 earnings but no Wave 2 earnings, instead of the individual-specific earnings growth rates estimated in the appendix. Results were qualitatively the same as those in Table 2.

Third, we checked whether the quadratic effects of age on self-employed retirement behaviour captured any peaks in the data at ages 60 and 65 (the female and male mandatory retirement ages for employees in Britain). No effects were found when two dummies were included: a Wald test statistic of $\chi^2(2) = 1.49$ was unable to reject the null hypothesis of insignificance. We also checked for outliers and identified seven observations with especially large accrual values, but removing them did not change the results in any noticeable way.

Fourth, we asked whether pooling self-employed and employee observations, makes any difference to the results. We investigated this question by interacting all variables and the constant term with a dummy for 'self-employment status'. This did not change any of the findings. A joint test of significant differences between the two occupational groups was upheld: a Wald test statistic of $\chi^2(18) = 68.82$ rejected the null hypothesis of a common specification.

Finally, we checked whether an intercept dummy was sufficient to capture gender differences in self-employed retirement behaviour. We did so by testing the explanatory power of a full set of gender and variable interaction terms. A Wald statistic of $\chi^2(17) = 16.83$ failed to reject the null hypothesis that separate specifications are unnecessary.

# 5 Policy discussion

Why might a better understanding of self-employment retirement behaviour matter to policy makers? In this section, we shall briefly address this question, on the working assumption that the government seeks to encourage labour force participation among older workers, while also seeking to promote self-employment separately as part of a general pro-enterprise stance.

One possible reason for the policy relevance of this research is that average retirement ages are substantially higher in self-employment than in paid employment, implying that encouraging older retired or unemployed employees to become self-employed could stimulate greater aggregate labour force participation. Second, knowing why some individuals choose to become self-employed in later life might also assist policy-makers in determining the appropriate structure of any self-employment or business start-up scheme targeted at older workers. An important related issue is the duration of job spells among those switching into self-employment in later life. In addition, governments might be interested in discovering whether, once workers are self-employed, there is anything they can do to keep them working there rather than retiring — again, as part of a labour force participation policy.

Regarding appropriate forms of policy intervention, it is important to bear in mind the results from our dynamic analysis which illustrated the persistence of occupational and participation choices in later life. Specifically, it would seem that one way of getting older workers to become self-employed is to encourage them to be self-employed when they are young. This highlights the value of formulating a long-term strategy to facilitate self-employment in the workforce, since many young self-employed workers eventually become old self-employed workers.

More generally, safeguarding workers' health appears to be an important aspect of keeping more people in work. Interestingly, the mechanisms appear to be different for employees and the self-employed. For employees, poor health increases the probability of retirement. While we could not find a similar effect for the self-employed, we saw that individuals in poor health are significantly less likely to choose a spell of self-employment in later life. Therefore advances in health-care that help keep older workers active appear to be a key aspect of any government initiatives to promote labour force participation and self-employment among older workers.

When we look at the characteristics of those employees who switch into self-employment in later life, other policy implications emerge. Only a limited number of older working employees switch into self-employment. Of those that do, few of them fall into the category of affluent workers using it as a bridge job to make a gentle transition to full retirement; most are peripheral workers with limited financial means who are engaged in a succession of short term and often part time jobs. If blanket policies were to be devised to make it easier for employees to become self-employed, our results suggest that these types of worker are the most likely to take up the policy. Unfortunately, relatively few of them end up creating long-lived businesses, being much more likely to retire than are established business owners who have been self-employed for a long time. Therefore it is not clear what would be gained by a policy that encouraged such workers to enter self-employment – a point that has added force as peripheral workers have also been identified as the most difficult to assist in unemployment-to-self-employment start-up programmes (Bendick and Egan, 1987). A more promising route might be job skill programmes and managerial training programmes dedicated to self-employed workers specifically (Devaney and Kim, 2003). And longer-term self-employment policies also look promising, as workers who persist with self-employment have the lowest average retirement rates of all workers.

Another class of policy interventions might seek to operate on the margin of keeping self-employed individuals in work rather than retiring. Any policies of this kind need to recognise that the self-employed exhibit different retirement behaviour than employees, although our findings are necessarily tentative given the relatively small size (197) of our sample. Because higher earnings around retirement seem to deter retirement by the self-employed, maintaining or cutting current levels of income tax might help sustain continued workforce participation by these individuals. But our results furnish few other concrete suggestions for policies that would also work towards this end.

## 6 Conclusion

Several findings emerge from this enquiry into the retirement behaviour of British self-employed workers based on *Retirement Survey* (RS) data. First, estimation of a simple life-cycle model identified a few significant determinants of self-employed retirement behaviour. Specifically, higher earnings around retirement decrease the probability of retirement, while age increases it. Also, self-employed individuals who were self-employed six years previously (the 'long term' self-employed) are significantly less likely to retire than those who were not. The 'switchers' into self-employment in later life do not resemble affluent employees downsizing to enjoy a gentle transition to full retirement. Instead, they tend to be marginal workers with unstable job histories and limited means, some of whom apparently turn to self-employment as a last resort before finally retiring. Retirement rates were found to be similar for switchers and employees who retired instead. The main difference between the self-employed and employees is therefore between the long term self-employed and employees. Our success in finding some significant determinants of self-employed retirement behaviour is reassuring in view of the well-documented heterogeneity of the self-employed, and the inability of researchers to explain other aspects of their labour supply behaviour (Rees and Shah, 1994).

Second, several variables that might have been expected to affect self-employed retirement propensities turned out to be statistically insignificant. These include poor health and gender, which both significantly affect employee retirement behaviour. Although the small self-employed sample size used here might explain this result, other explanations grounded in institutional differences are also tenable. These include mandatory employee retirement ages that come earlier for females than for males, and government- and employer-provided sickness benefits. None of these provisions


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apply to the self-employed.

Third, our dynamic analysis identified only a limited number of transitions between different labour market states among older workers, with persistence in retirement, paid employment and self-employment being the norm. A greater proportion of older employees made a transition to self-employment than the other way round, but this amounted to only 3.6% of all older employees over a 5 year time horizon. We also found that while poor health does not affect the retirement behaviour of older self-employed workers directly, it does significantly decrease the probability that workers will move into this kind of work.

The policy implications of our findings can be summarised as follows. First, the scope for government to encourage greater labour force participation among older workers by promoting self-employment as a vehicle may be quite limited. The persistence of employment choices in later life, and the finding that only the long-term self-employed retire significantly later than employees do, highlights the importance of promoting self-employment among younger workers, some of whom will remain in self-employment into old age. This suggests a longer term policy horizon, though to the extent that these individuals are likely to enter self-employment in any case, the deadweight costs of such a policy are likely to be non-trivial. Second, policies to promote better health among older workers are likely to affect the self-employed mainly by operating on the occupational choice margin, whereas for employees the policy would mainly work by postponing retirement.

Clearly, much remains to be done to refine the analysis and the policy recommendations advanced here, and to dig more deeply into the nature of employment transitions in later life. The availability of more high quality longitudinal data — such as the new English Longitudinal Survey of Ageing — will be an integral part of this research agenda.

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Table 1. Summary statistics of lifetime wealth and the accrual

| | Non-zero (%) | Quantiles | | | | |
|---|---|---|---|---|---|---|
| | | **min.** | **25%** | **Median** | **75%** | **max.** |
| *Sources of wealth* § | | | | | | |
| Housing (35.59 %) | 84 | 0 | 31939 | 37297 | 71651 | 250674 |
| Financial non-housing (17.29 %) | 86 | 0 | 954 | 6937 | 24520 | 185024 |
| State pension (18.35 %) | 93 | 0 | 20007 | 26163 | 29963 | 91924 |
| Private pension (6.83 %) | 39 | 0 | 0 | 0 | 10380 | 167214 |
| Occupational pension (7.65 %) | 32 | 0 | 0 | 0 | 8714 | 178486 |
| Earnings (13.61 %) | 54 | 0 | 0 | 1011 | 18556 | 543904 |
| Business (0.68 %) | 4 | 0 | 0 | 0 | 0 | 108062 |
| Lifetime, $\Omega$ | 100 | 15547 | 76871 | 115240 | 193788 | 865124 |
| *Accrual, $\Omega_R$* | | | | | | |
| Non-retired † | 65 | 0 | 2947 | 8450 | 16426 | 123500 |
| Retired | 97 | 0 | 130 | 1752 | 7808 | 30790 |

Notes:
Sample size: 197. Authors' calculations from Retirement Survey data. All values expressed in £, net of tax, 1994 prices.

§. Average percentages of lifetime wealth in parentheses.
†. Broad definition of retirement.

*Table 2. Determinants of self-employed retirement probabilities*

| | Broad ret. definition | | Narrow ret.definition . | |
|---|---|---|---|---|
| | (1a) | (1b) | (2a) | (2b) |
| Constant | 2.096 * | 2.160 * | 2.503 * | 2.622 ** |
| | (1.003) | (1.015) | (1.038) | (1.048) |
| No. Children | 0.020 | 0.016 | 0.047 | 0.048 |
| | (0.078) | (0.077) | (0.080) | (0.080) |
| Disabled | 0.067 | 0.071 | -0.321 | -0.318 |
| | (0.282) | (0.283) | (0.298) | (0.302) |
| Married | -0.019 | -0.006 | 0.045 | 0.074 |
| | (0.349) | (0.347) | (0.335) | (0.331) |
| Linear age | 12.482 ** | 12.345 ** | 14.424 ** | 14.339 ** |
| | (3.023) | (2.947) | (3.212) | (3.143) |
| Quadratic age | -4.920 | -4.979 | -6.086 * | -6.078 * |
| | (2.932) | (2.881) | (2.695) | (2.647) |
| Social class, s s=1 | 0.625 | 0.624 | 0.607 | 0.595 |
| | (0.662) | (0.661) | (0.679) | (0.677) |
| s=2 | 0.101 | 0.114 | -0.211 | -0.197 |
| | (0.628) | (0.627) | (0.645) | (0.645) |
| s=3 | 0.701 | 0.722 | 0.901 | 0.934 |
| | (0.677) | (0.679) | (0.706) | (0.710) |
| s=4 | 0.570 | 0.586 | 0.390 | 0.388 |
| | (0.620) | (0.618) | (0.634) | (0.631) |
| s=5 | 0.609 | 0.602 | -0.007 | -0.012 |
| | (0.711) | (0.712) | (0.727) | (0.728) |
| Poor health score | 0.010 | 0.010 | 0.027 | 0.025 |
| | (0.035) | (0.035) | (0.037) | (0.036) |
| Long-term self-emp | -0.809 ** | -0.799 ** | -0.906 ** | -0.895 ** |
| | (0.266) | (0.262) | (0.277) | (0.275) |
| Female | -0.005 | -0.027 | 0.044 | 0.023 |
| | (0.306) | (0.303) | (0.293) | (0.287) |
| Cares for sick relative | 0.459 | 0.459 | 0.712 | 0.731 |
| | (0.459) | (0.462) | (0.481) | (0.492) |
| Spouse works | -0.432 | -0.437 | -0.636 * | -0.655 * |
| | (0.289) | (0.290) | (0.286) | (0.286) |
| Vocational Quals. | 0.115 | 0.107 | -0.091 | -0.121 |
| | (0.292) | (0.295) | (0.282) | (0.277) |
| Years education | -0.052 | -0.056 | -0.059 | -0.070 |
| | (0.064) | (0.065) | (0.068) | (0.069) |
| Accrual | -1.637 | -2.430 * | -0.932 | -2.702 * |
| | (2.720) | (1.083) | (3.273) | (1.333) |
| Accrual * Lifetime wealth | -0.285 | | -0.886 | |
| | (1.120) | | (1.653) | |

| | | | | | |
|---|---|---|---|---|---|
| – log likelihood | | 85.684 | 85.763 | 82.534 | 82.804 |
| Overall significance | | 87.296 ** | 85.115 ** | 101.780 ** | 100.177 ** |
| Hit rate (%) | | 77.665 | 78.680 | 79.695 | 78.680 |
| Hosmer-Lemeshow $\chi^2$ (6) | | 6.422 | 5.952 | 3.756 | 4.936 |
| Fit: | Estrella | 0.413 | 0.410 | 0.478 | 0.474 |
| | $R^2$ - ML | 0.354 | 0.352 | 0.403 | 0.400 |

Notes:
Sample size: 197 for all regressions.

All variables are defined in the text, with Accrual and Lifetime Wealth each expressed in hundreds of thousands of pounds.

Standard errors in parentheses, obtained using a sandwich style robust covariance estimator.

* Indicates significance at 5%; ** indicates significance at 1%. Overall significance is a $\chi^2$ test of the joint significance of the coefficients; degrees of freedom are 19 in columns 1a and 1b and 18 in columns 2a and 2b. Hit rate is the proportion of correct predictions, using a 50 per cent cut-off rule. The Hosmer-Lemeshow statistic evaluates divergence between actual and predicted values: a significant value indicates a large divergence. Estrella and $R^2$-ML are "$R^2$"-type goodness of fit statistics.

Table 3. Characteristics of the self-employed sample in 1994 disaggregated by job history: mean values

| | **Employees in wave 1** | **"Long term" self-employed** | **P value** |
|---|---|---|---|
| *Discrete variables* | | | |
| *Retired (Broad)* | *0.831* | *0.500* | *0.000 *** |
| (Narrow) | 0.807 | 0.430 | 0.000 ** |
| Married | 0.819 | 0.833 | 0.797 |
| Disabled | 0.470 | 0.351 | 0.093 |
| Female | 0.398 | 0.237 | 0.016 * |
| Spouse works | 0.253 | 0.193 | 0.316 |
| Vocational Quals. | 0.181 | 0.202 | 0.711 |
| Cares for sick relative | 0.050 | 0.060 | 0.688 |
| *Continuous variables* | | | |
| Age | 67.868 | 65.325 | 0.001 ** |
| Poor health score | 2.465 | 1.513 | 0.086 |
| $\ln(\Omega)$ | 11.394 | 11.802 | 0.000 ** |
| $\ln(1+\Omega_R)$ | 4.984 | 7.735 | 0.000 ** |
| Social class scale | 2.880 | 3.053 | 0.373 |
| Years education | 10.096 | 10.518 | 0.137 |
| No. Children | 2.241 | 2.368 | 0.567 |
| Job history variables | | | |
| No. jobs between waves | 0.470 | 0.096 | 0.000 ** |
| part-time | 0.337 | 0.044 | 0.000 ** |
| full-time | 0.133 | 0.053 | 0.187 |
| No. jobless spells between waves | 0.386 | 0.018 | 0.000 ** |
| Sample size | 83 | 114 | |

Notes:
Variables defined in the text. For asterisks, see Table 2.

Statistical tests: For continuous and job history variables, p-values are based on t-tests which are robust to unequal variances. For discrete variables, p-values are based on likelihood ratio $\chi^2$ tests.

Source: The Retirement Survey.

*Table 4. Determinants of employee retirement probabilities*

| | | Broad ret. definition (3) | Narrow ret.definition . (4) |
|---|---|---|---|
| Constant | | 0.474 | 0.382 |
| | | (0.426) | (0.413) |
| No. Children | | -0.082 * | -0.068 |
| | | (0.041) | (0.040) |
| Disabled | | 0.109 | 0.153 |
| | | (0.161) | (0.160) |
| Married | | 0.234 | 0.198 |
| | | (0.159) | (0.154) |
| Linear age | | 29.965 ** | 22.157 ** |
| | | (5.291) | (4.534) |
| Quadratic age | | -1.402 | -5.733 |
| | | (5.127) | (5.164) |
| Social class, s | s=1 | -0.295 | -0.336 |
| | | (0.246) | (0.238) |
| | s=2 | -0.146 | -0.172 |
| | | (0.234) | (0.230) |
| | s=3 | 0.093 | -0.052 |
| | | (0.241) | (0.234) |
| | s=4 | 0.226 | 0.082 |
| | | (0.241) | (0.236) |
| | s=5 | 0.177 | 0.242 |
| | | (0.383) | (0.377) |
| Poor health score | | 0.061 * | 0.062 * |
| | | (0.027) | (0.026) |
| Long-term self-emp | | -0.018 | -0.114 |
| | | (0.227) | (0.206) |
| Female | | 0.392 ** | 0.376 ** |
| | | (0.145) | (0.140) |
| Cares for sick relative | | 0.228 | 0.260 |
| | | (0.262) | (0.254) |
| Spouse works | | -0.552 ** | -0.564 ** |
| | | (0.143) | (0.142) |
| Vocational Quals. | | -0.083 | -0.021 |
| | | (0.166) | (0.162) |
| Years education | | 0.0001 | 0.003 |
| | | (0.034) | (0.033) |
| Accrual | | 2.040 | 0.885 |
| | | (1.219) | (1.241) |

| | | | |
|---|---|---|---|
| – log likelihood | | 301.341 | 316.137 |
| Overall significance | | 162.372 ** | 144.177 ** |
| Hit rate (%) | | 76.963 | 73.997 |
| Hosmer-Lemeshow $\chi^2$ (8) | | 9.638 | 10.476 |
| Fit: | Estrella | 0.273 | 0.243 |
| | $R^2$ - ML | 0.247 | 0.222 |

Notes:
Source: The Retirement Survey. Sample size: 573 for both regressions.

*Table 5. Transition matrix of employment status*

| **Employment group** | **Retired in 1994** | **Working employee in 1994** | **Working self-employed in 1994** | **Total number, 1988/89** |
|---|---|---|---|---|
| **Retired in 1988/89** | 1393 | 41 | 7 | 1441 |
| **Working employee in 1988/89** | 643 | 319 | 12 | 974 |
| **Working self-employed in 1988/89** | 73 | 4 | 57 | 134 |
| **Total number, 1994** | 2109 | 304 | 76 | 2549 |

Notes:
Source: The Retirement Survey, 1994.

The sample size of 76 working self-employed exceeds the 71 used in the estimation of (4) and (6), as 5 observations had to be dropped in those estimations owing to missing data on explanatory variables.

*Table 6. Multinomial logit analysis of dynamic retirement and employment decisions*

| | Working as an employee by 1994 | Working as self-employed by 1994 |
|---|---|---|
| *Dummy for* | | |
| retired in 1988/89 | -1.640 ** | -3.779 ** |
| | (0.343) | (0.869) |
| employee in 1988/89 | -0.049 | -3.128 ** |
| | (0.337) | (0.626) |
| No. Children | -0.009 | -0.025 |
| | (0.031) | (0.028) |
| Disabled | -0.216 | 0.957 |
| | (0.242) | (0.624) |
| Married | -0.247 | -0.310 |
| | (0.197) | (0.424) |
| Linear age | -71.146 ** | -60.597 ** |
| | (11.045) | (18.986) |
| Quadratic age | -9.369 | -6.415 |
| | (11.736) | (12.175) |
| Social class, s s=1 | -0.367 | -0.896 |
| | (0.271) | (0.948) |
| s=2 | -0.148 | 0.010 |
| | (0.267) | (0.826) |
| s=3 | -0.393 | -0.016 |
| | (0.276) | (0.869) |
| s=4 | -0.406 | -0.494 |
| | (0.294) | (0.826) |
| s=5 | -0.525 | 0.229 |
| | (0.502) | (1.108) |
| Poor health score | -0.008 | -0.470 ** |
| | (0.040) | (0.169) |
| Female | -0.245 | -0.255 |
| | (0.205) | (0.552) |
| Cares for sick relative | 0.008 | 0.053 |
| | (0.107) | (0.399) |
| Vocational Quals. | -0.131 | 0.332 |
| | (0.181) | (0.395) |
| Years education | -0.108 ** | -0.090 |
| | (0.032) | (0.072) |

| | |
|---|---|
| – log likelihood | 716.573 |
| Overall significance | 753.930 ** |
| Hit rate (%) | 85.833 |
| Pseudo-$R^2$ | 0.345 |

Notes:
Sample size: 2047. Robust standard errors appear in parentheses. The coefficients are log-odds ratios of being an employee or self-employed relative to retired in 1994.

All explanatory variables take 1988/89 values.

## *Appendix*

Table A1. Earnings growth regressions used for imputing accrual values

| | **Self-employed** | | **Employees** | |
|---|---|---|---|---|
| | **Coefficient** | **St. error** | **Coefficient** | **St. error** |
| Constant | 5.640 * | 2.373 | | |
| Social class | -0.178 * | 0.083 | | |
| Mixed job history | 0.966 ** | 0.284 | | |
| Work hours | 0.019 ** | 0.007 | | |
| *Log earnings* | *-0.637 ***** | *0.129* | *-0.403 ***** | *0.074* |
| Linear age | -0.064 | 0.038 | 0.171 ** | 0.029 |
| Quadratic age | | | -0.002 ** | 0.000 |
| Female | | | -0.310 * | 0.155 |
| Years education | | | -0.078 * | 0.039 |
| Resides in South East | | | 0.345 * | 0.139 |
| Sample size | 61 | | 208 | |
| $\sigma^2_\omega$ | 0.763 | | 0.884 | |
| $R^2$ | 0.441 | | 0.270 | |
| Overall significance: F | 8.834 ** | | 7.789 ** | |

Notes:

All explanatory variables measured at 1988/89 (Wave 1). *Social class* is that of the most recent job; *Mixed job history* is a dummy variable taking the value 1 if the individual has had a job history with a mixture of paid employment and self-employment, and 0 otherwise; and *Resides in the South East* and *Female* are also dummy variables.

For asterisks, see notes to Table 2.

# The Retirement Behaviour of the Self-employed in Britain



**Abstract**

We analyse the retirement behaviour of older self-employed workers, using a life cycle framework and a multinomial logit model of dynamic employment and retirement choices. Using data from the two-wave Retirement Survey, we find that greater actual or potential earnings decrease the probability of retirement among the self-employed. In contrast to employees, none of gender, health or family circumstances appear to affect self-employed retirement decisions. The dynamic analysis reveals that relatively few employees and virtually no retirees switch into self-employment in later life. The switches that do occur are motivated less by attempts to use self-employment as a bridge job or 'stepping stone' to full retirement, than by self-employment being a last resort for less affluent workers with job histories of weak attachment to the labour market. We compare self-employed and employee retirement behaviour, and discuss the policy implications of our results.

# 1 Introduction

This paper asks what determines the retirement behaviour of older self-employed workers, and analyses the dynamic process of occupational and retirement choices in later life. Specifically, we search for the factors that explain when the self-employed retire, who chooses to become and remain self-employed in later life, and differences in self-employed retirement behaviour compared with employees.

There are several reasons why this topic may be of interest to academics and policy-makers. First, while retirement among employees has been heavily researched in the academic literature, relatively little is known about the retirement behaviour of the self-employed.[1] Yet the self-employed face different institutional restrictions on retirement and possibly also different incentives to retire, having higher labour force participation rates and lower retirement rates than employees.[2] This makes self-employment a potentially interesting occupational choice to policy-makers concerned about falling labour force participation rates, ageing populations, and the prospect of substantial future publicly-funded pension liabilities (Disney, 2000; Bovenberg, 2003). It raises the prospect that schemes to promote self-employment among older workers might fulfil twin objectives: of increasing overall labour force participation rates among older workers while stimulating the economy to become more competitive and entrepreneurial (OECD, 2000).

Clearly a better understanding of self-employed retirement behaviour is needed before one can begin to sketch the outlines of possible self-employment schemes for older workers. In particular, we require evidence about whether lower self-employed retirement rates relative to employees can be explained in terms of different preferences for leisure relative to work; different incentives; or different institutional structures. Re-

[1] For studies on employee retirement, see Stock and Wise (1990a, 1990b), Berkovic and Stern (1991), Lumsdaine *et al* (1992), Blau (1994, 1998), Ruhm (1996), Rust and Phelan (1997), Samwick (1998), Friedberg (1999, 2003), Gustman and Steinmeier (2000a, 2000b, 2001), Baker (2002) and Blundell *et al* (2002). In contrast, we know of few studies of the labour market behaviour of older self-employed workers, chiefly the US studies of Quinn (1980), Fuchs (1982), and Bruce *et al* (2000).

[2] For example, while only about one tenth of the overall workforce is self-employed in the US and UK, about one third of the workforce over 65 in each country is self-employed – a proportion that has been relatively stable over time (Iams, 1987; Moralee, 1988; Bruce *et al*, 2000).

garding institutions, for example, the self-employed do not usually receive employer- or government-provided sickness leave or benefits. Instead they have to provide their own pension and health-care coverage, which suggests that life cycle saving might be an integral aspect of self-employed behaviour. At the same time, self-employed workers in Britain do not face a mandatory retirement age, unlike employees. Their incentives might also differ from those of employees. In particular, the self-employed do not face the problem of timing their separation from a firm in order to maximise the value of occupational pension rights. In contrast, this problem is of primary importance for employees with occupational pension plans where it has spawned several rich models, including ones based on option value (Stock and Wise, 1990a, 1990b) and dynamic programming (Rust and Phelan, 1997) approaches. These models may be less appropriate for the self-employed, in part because they abstract from non-pension asset accumulation in order to focus on endogenous switches in and out of pension schemes; and also because the self-employed do not face incentive problems embodied in occupational pen plans, relying instead on personal savings to finance their retirement behaviour. For this reason, we use a life cycle approach to model self-employed retirement behaviour.

It turns out that the life cycle model used in this paper can shed some light on the determinants of self-employed retirement behaviour. We estimate the model using data from the two-wave British *Retirement Survey* — the best micro-data source currently available in Britain. Because the self-employed are a minority of the workforce, the *Retirement Survey* yields only a relatively small sample size (just under 200); nevertheless, it is still possible to generate some interesting new findings. Among these, we find that the determinants of self-employed retirement differ from those impacting on employee retirement — an important point which any policy intervention should take account of. We supplement this analysis by briefly exploring dynamic occupational and retirement choices in later life, obtaining evidence about the characteristics and subsequent retirement behaviour of older workers who switch into self-employment. These are presumably the individuals that any self-employment scheme for older workers is likely to attract; and we discuss the implications of our findings for policies attempting to promote self-employment via such schemes. To anticipate our findings, we suggest that encouraging older workers to become and remain self-employed is unlikely to succeed as most switchers into self-employment in later life retire shortly thereafter. Also, advances in health care that help keep older workers active appear to be a key aspect of any government initiatives to promote labour force participation and self-employment among older workers. Specially, older employees in poor health are more likely to retire, and less likely to switch into self-employment.

The paper proceeds as follows. Section 2 outlines a simple model of retirement based on the life cycle hypothesis, together with its stochastic representation, and suggestions for extensions to take account of possible sample selection bias in the presence of unobserved heterogeneity and endogenous occupational choice. Section 3 describes the data set, and the measurement of the explanatory variables. Section 4 presents and interprets the results. This comprises a static analysis of retirement decisions, a dynamic analysis of transitions between different employment states over the two waves of the Survey, and a sensitivity analysis. Section 5 discusses the policy implications of our results, while Section 6 concludes.

# 2 The model

## 2.1 The optimisation problem

The problem facing a specific agent aged $t$ who plans to retire at age $R$ and live until age $T$ is

$$\max_{c(\cdot)} U = \left\{ \int_t^R \exp\{-\delta(s-t)\}\, u(c(s),0)\, ds + \int_R^T \exp\{-\delta(s-t)\}\, u(c(s),1)\, ds \right\}$$

$$\text{subject to} \quad \int_t^T \exp\{-r(s-t)\}\, c(s)\, ds = \Omega(R)$$

where $c(\cdot)$ is consumption through time, $s$ is an age index, $u(\cdot,\cdot)$ is an 'instananeous' utility function defined on consumption and retirement status respectively, $\delta$ and $r$ are discount and interest rates, respectively, and $\Omega(R)$ is current total lifetime wealth, which is a function of retirement age. Lifetime wealth is the value of financial, business and housing assets plus the present value of all state pension (social security), personal pension and labour incomes that an individual commands over the remainder of their life. Its annuity stream is commonly referred to as permanent income.

We can solve this problem for the optimal consumption path $c^*(\cdot, R)$ treating $R$ as parametric, and substitute the result back into the maximand to give the indirect utility function, $U^*(R)$. Then we can maximise the indirect utility function over $R$ to identify the optimal retirement age. Here we acknowledge that a key feature of being self-employed is control over the retirement age. Using the envelope theorem gives

$$\frac{dU^*}{dR} = -\exp\left\{-\delta(R-t)\right\} \nabla(c^*(t), R) + \lambda^* \frac{d\Omega}{dR} \tag{1}$$

where $\nabla(c^*(t), R) := u(c^*(t), 1) - u(c^*(t), 0)$ is utility in retirement relative to work, and $\lambda^* := dU^*/d\Omega \geq 0$ is the marginal utility of wealth. We would usually expect that $\nabla(c^*(t), R) > 0$, i.e. the same amount of consumption is more enjoyable when combined with leisure time (i.e. in retirement). Because of earnings opportunities in work, we would also expect that $d\Omega/dR > 0$, i.e. deferring retirement by one period enhances the current stock of lifetime wealth by the amount of extra income generated in that period.

The meaning of (1) is straightforward. The marginal utility of postponing the retirement age $R$ by a period involves foregoing utility from leisure – with a negative impact – but this is compensated by greater present and future consumption possibilities afforded by greater lifetime wealth, which has a positive impact.

In order to analyse the determinants of an individual's current retirement status, consider an individual who is considering retiring. By setting $R = t$ in $U^*$ they can examine the utility that follows from retiring immediately. Whether or not immediate retirement is beneficial is given by the sign of the derivative of $U^*$ with respect to $R$, namely

$$\left.\frac{\partial U^*}{dR}\right|_{R=t} = -\nabla(c^*(t), t) + \lambda^*\,\Omega_R \tag{2}$$

where $\Omega_R := d\Omega/dR$ at $R = t$. For the reasons given above, both terms in (2) are likely to be positive, and so there will be individuals for whom it is beneficial to retire (negative sign) and others for whom it is beneficial to continue to work (positive sign). Consequently it seems reasonable to model the probability that the individual is retired at age $t$ as some monotonic increasing function of the negative of (2), written as

$$\pi^* = \mathsf{Pr}\big[R \leq t\big] = F(v^*) \qquad \text{where} \quad v^* = -\left.\frac{\partial U^*}{dR}\right|_{R=t} \tag{3}$$

where $F(\cdot)$ is called the 'conditional mean function' in standard econometrics terminology (Greene, 2003). We call this the 'retirement equation'.

## 2.2 A statistical framework across individuals

For any individual we can observe retirement status, $I_{R<t}$, where $I_p$ is the indicator function of the proposition $p$. We can also observe a number of covariates that distinguish individuals from one another, $x$ say. These covariates are associated with the level of $v^*$ through $\nabla\big(c^*(t), t\big)$. We might write

$$v^* \approx f(x) - \lambda^*\,\Omega_R\,,$$

where $f$ is an unknown function which depends upon the unknown utility function (taken to be a function of $x$), and $\Omega_R = d\Omega/dR$. Note the importance of an appropriate specification of the vector $x$. It should capture person-specific preferences relating to the work-leisure trade-off, to facilitate identification of any *preference* for retirement (i.e., $f(x)$) separately from the *incentives* for retirement, given by $\lambda^*\,\Omega_R$.

The incentive $\Omega_R$ can be measured directly if earnings from an extra period of work are observed or imputed, as we explain in the next section. Note that $\Omega_R$

(which is henceforth called the 'accrual') is not necessarily 0 for retired individuals. From the way in which we have solved the problem, the accrual is "the incremental change in my lifetime wealth were I currently to be working and decided not to retire immediately but to defer for a small amount of time". It is true that this value may be easier to compute for those currently working, but it is also clear that those who have retired and can return to employment ought also to be making a calculation of this kind.

So far $\lambda^*$ has been taken to be a constant, capturing the size of any 'substitution' effect in retirement behaviour. More generally, we can allow for the possibility of diminishing marginal utility of lifetime wealth by writing $\lambda^* = \lambda^*(\Omega) = \lambda_0 - \lambda_1\Omega$, where $\lambda_0 > 0$, $\lambda_1 \geq 0$ subject to $\lambda^*(\Omega) \geq 0$. Then $\lambda_1$ captures specifically any 'income' effect in retirement behaviour. In our empirical application, $\Omega$ can be measured directly from micro data, while the sign of $\lambda^*$ can be checked in the results.

For the statistical treatment of this model, our data comprise the $n$ tuples $(\pi_i, x_i, \Omega_i, \Omega_{Ri})$, where $\pi_i$ is the indicator function of retirement for individual $i$. We assume that these tuples are exchangeable. We use the probit function for $F$ and write $\pi_i^* := \Phi(v_i^*)$, where $\Phi(\cdot)$ is the standard normal distribution function. Using linear functionals for $f$ as well as $\lambda^*$, our empirical model is

$$v_i^* = \alpha_1 + x_i^T\gamma_1 - (\lambda_0 - \lambda_1\Omega_i)\Omega_{Ri} + \epsilon_{i1} \tag{4}$$

where $\epsilon_{i1}$ is an uncorrelated gaussian error term. The parameter vector $\theta := (\alpha_1, \gamma_1, \lambda_0, \lambda_1)$ can be estimated by maximising a standard probit log likelihood function associated with (4). A testable prediction of the life-cycle model is that the accrual has a negative effect, and lifetime wealth a zero or positive effect, on the probability that a given individual is retired. Note that the life cycle model suggests that lifetime wealth enters the retirement equation interactively rather than separately. The logic is that the Lagrange multiplier $\lambda^*$ maps the accrual into retirement behaviour, since $\lambda^*$ is the marginal utility of lifetime wealth. Allowing $\lambda^*$ to depend on lifetime wealth then gives rise to the interaction term in (4). Later we will test whether our empirical results are sensitive to this aspect of the model specification.

An important question is whether there is unobservable heterogeneity with respect to retirement status. Do the self-employed differ from employees in their retirement behaviour in ways that cannot be captured by our covariates? Specifically, might there be unobservable variables that drive both retirement behaviour and the likelihood of being self-employed? For example, perhaps very energetic individuals who enjoy work and are therefore reluctant to retire are more likely to become self-employed. To answer this question, we extend our statistical framework in the following way.

Consider the following probit 'selection' equation:

$$s_i^* = \alpha_2 + y_i^T \gamma_2 + \epsilon_{i2}\,, \tag{5}$$

where $i$ is self-employed ($s_i = 1$) if $s_i^* \geq 0$, and is an employee ($s_i = 0$) if $s_i^* < 0$; where $y_i$ is a vector of individual characteristics that bear on the occupational choice decision, $y_i \neq x_i$ in general; and where $\epsilon_{i2}$ is an uncorrelated gaussian error term, such that $\epsilon_{i1}, \epsilon_{i2} \sim \text{BVN}(0, 0, 1, 1, \rho)$. The key point is that $(\pi_i, x_i, \Omega_i, \Omega_{Ri})$ is only observed for $i$ if $s_i = 1$. The log-likelihood function for this model is

$$\begin{aligned} \ln L(\Theta) \;=\; & \sum_{i=1}^{n} \big\{ \pi_i s_i \ln \Phi_2\big(\alpha_1 + x_i^T\gamma_1 - (\lambda_0 - \lambda_1\Omega_i)\Omega_{Ri}, \alpha_2 + y_i^T\gamma_2, \rho\big) \\ & \quad + s_i(1-\pi_i) \ln \Phi_2\big(-\alpha_1 - x_i^T\gamma_1 + (\lambda_0 - \lambda_1\Omega_i)\Omega_{Ri}, \alpha_2 + y_i^T\gamma_2, -\rho\big) \\ & \quad\quad -(1-s_i)\ln \Phi\big(-\alpha_2 - y_i^T\gamma_2\big)\big\}\,, \end{aligned} \tag{6}$$

where $\Phi_2(\cdot,\cdot,\cdot)$ denotes the bivariate normal distribution function. After estimating the parameters $\Theta := (\theta, \alpha_2, \gamma_2, \rho)$ by maximising (6), one can check for sample selection by testing the hypothesis that $\rho = 0$. Thus controlling for sample selection complements the observable heterogeneity in work-leisure preferences characterised by $f(x)$, with unobservable heterogeneity in these preferences.

# 3 Data set and methodology

## 3.1 The *Retirement Survey* data set

We estimated the model outlined in the previous section using data from the British *Retirement Survey* (RS). The RS is a rich two-wave data set containing individual- and household-level information on personal and financial characteristics, health and labour market behaviour around the time of retirement. The first wave contains information from interviews conducted in 1988/89 with 3543 randomly selected respondents who were aged between 55 and 69, together with 609 spouses outside this age range. The second wave took place in 1994, which involved re-interviewing about two thirds of the original respondents and spouses in a single face-to-face survey. The other one third of respondents either did not respond to the second interview or had died between the two waves. Apart from being older on average, the non-responders do not appear to be substantially different from those who did participate in the second wave (Attanasio and Emmerson, 2001). Data from both waves are used in the current paper, with an emphasis on explaining retirement behaviour and occupational choices in the second wave.

An individual is defined as self-employed in the RS if their most recent job was in self-employment rather than paid employment. Of the total sample, complete information was available for 197 self-employed individuals.[3] This is a smaller sample than is often used for studying employee retirement behaviour, reflecting the fact that only a minority of the workforce is self-employed. It is also smaller than samples on self-employed workers that have been drawn from the US *Retirement History Survey*, including those of Fuchs (1982) ($n = 443$) and Quinn (1980) ($n = 836$). The limitations of using a relatively small sample size should therefore be borne in mind when the empirical results are discussed.

[3]Of the 1994 sample, 282 individuals were self-employed, of whom 85 were omitted because there was incomplete information about one or more component of their lifetime wealth (see below). The omitted individuals did not appear to have different observable characteristics to those remaining in the sample.

The RS contains several alternative definitions of retirement. One is a broad definition, whereby an individual is retired if they consider themselves to be so. Self-reported definitions of this kind may be criticised on the grounds that some individuals misclassify themselves. For example, it can be objected that some of the 'self-employed' respondents are not actually self-employed at all, but are claiming self-employment status (e.g., 'consultancy') to justify retirement to their peers. We will therefore also utilise in our empirical work an additional, narrower, definition of retirement. To be defined as retired under this definition, an individual must be out of work and not seeking work, and must cite being retired as the main reason for not working.[4]

To give some idea of the difference between the measures, some 64% of the sample are retired on the broad definition, compared with 59% on the narrow definition. The proportion retired on the broad definition compares with 81% of all individuals in the 1994 RS (Tanner, 1998). This reflects the greater tendency of the self-employed compared with employees to work beyond the statutory retirement age, a well-known 'stylised fact' in the UK (Tanner, 1997) and US (Quinn, 1980; Fuchs, 1982; Sickles and Taubman, 1986; Bruce *et al*, 2000). Indeed, according to the 1994 RS, 73% of the self-employed in 1994 worked beyond the statutory employee retirement age of 65 for men and 60 for women.

The RS also enables the researcher to compute lifetime wealth $\Omega$, and the accrual, $\Omega_R$. We next discuss issues involved in measuring these two variables, before describing the other explanatory variables used in the empirical work.

## 3.2 Explanatory variables: Lifetime wealth and accrual

Because the computation of lifetime wealth imposes considerable demands on micro data, most previous studies have tended to consider the effects of just a subset of its

[4]Several other retirement definitions have also been used in the literature, including ones based on a discontinuous drop in wages or hours worked (Gustman and Steinmeier, 1984; Burtless and Moffitt, 1985), or whether individuals receive low or zero wages (Honig and Hanoch, 1985). Information on work hours is unavailable in the RS, ruling out use of the first definition; and many self-employed report zero incomes (Parker, 1997) making the second definition problematic.

components on retirement.[5] In contrast, the RS enables a comprehensive measure of lifetime wealth to be computed, encompassing many of those recommended in the literature (see, e.g. Wolff, 1987; Zagorsky 1999). As well as housing and financial wealth, it is also possible to calculate capitalised values of state pension, private and occupational pension entitlements; future expected earnings; and expected future business resale values. The RS contains detailed data on all of these sources of lifetime wealth, which is computed at the individual level.

To save space, we give only a broad outline of the construction of lifetime wealth (see Parker, 2003, for a fuller explanation). Information about house values and mortgage debts outstanding in 1994 was used to calculate net housing wealth. Because of the wide coverage of financial assets in the RS, a comprehensive measure of financial wealth was straightforward to compute from the 1994 data. More work was required to compute state, private and occupational pension wealth. Fortunately, the RS contains a wealth of information across the two waves that make relatively refined estimates possible. This includes detailed information about income indexation formulae and other rules and provisions of each individual pension scheme. Also, observed pension incomes in the first wave enabled pension entitlements in the second wave to be estimated for individuals with incomplete pension records, by matching individuals with missing data in wave 2 to cases with observed data in both waves. The longitudinal nature of the RS, and its detailed file of job history data, also enables the researcher to infer current and future earnings of those working and the imputed values of those no longer working (see below for further details). Recalling that lifetime wealth measures one's control over total current *and future* resources, earnings wealth was estimated by applying average actual income growth rates to actual or imputed 1994 incomes until the expected age of retirement (see below). Finally, business

[5]For example, Diamond and Hausman (1984), Honig and Hanoch (1985) and Burtless (1986) considered only financial wealth. Samwick (1998) also included private and state (social security) pension wealth; the latter alone was used by Gordon and Blinder (1980), McCarty (1990) and Reimers and Honig (1996). Pension wealth also appears in Mitchell and Fields (1984), who additionally used the NPV of labour market incomes ('earnings wealth'). Hogarth (1988) used just earnings wealth. See Hurd (1990) for a discussion of all of these sources of lifetime wealth. Many more authors analyse only single-period income flows, from investments, pensions and earnings, without accounting for future values of these flows.

wealth was computed from responses to the RS question about the expected value of businesses and the expected sale date. In the computation of the lifetime wealth components, all future income flows were capitalised using a discount rate of 3%; and individual-specific life expectancy tables were used in the capitalisation calculations.

[INSERT TABLE 1 AROUND HERE]

Because the composition of lifetime wealth might be of independent interest, Table 1 summarises the holdings of each component, as well as the aggregate value, and the accrual variable (see below) for our self-employed sample. Despite some limitations — including the common use of banded data from which point estimates are imputed, and the small number of respondents claiming business wealth[6] — the RS has the advantage of containing comprehensive data on current wealth and future entitlements. Also, its sample wealth component distributions match those published in national accounts data (Disney *et al*, 1997). We would suggest however that earnings wealth should be treated with some caution because 1994 earnings were uprated to estimate post-1994 values by using the observed average self-employment income growth rate, obtained from National Accounts data. The use of a common rather than an individual-specific income growth rate estimated between the waves was motivated by the different macroeconomic conditions prevailing after 1994 (high growth) compared with 1988/89–94 (recession and low growth). While this is likely to avoid the use of inappropriate growth rates, it is however also likely to understate the true variability of earnings within the sample. Note also that if the self-employed under-report their incomes (Pissarides and Weber, 1989), the effect of this cannot be easily removed from the present value calculation.

Despite these limitations, we felt it appropriate to retain earnings wealth in the analysis. As pointed out by Baker *et al* (2003), lifetime earnings might capture heterogeneity in work preferences and so assist with identification in the cross-sectional

[6]The small proportion of respondents claiming any business wealth in Table 1 partly reflects a large number of missing values to responses to this variable, which may be because many self-employed people do not know what their business is worth. However, it might also partly reflect the fact that many self-employed workers are in occupations like construction, trades and crafts, sales, and vehicle maintenance in which there are virtually no tangible assets to sell.

analysis.

Turning next to the accrual, recall that this is defined as the incremental value from deferring retirement for another period. For the self-employed, earnings are the only component of lifetime wealth that is *directly* affected by such a deferral. This is because neither early retirement provisions in occupational pensions nor SERPS entitlements are relevant for the self-employed; private pension annuities are invariant to the retirement date; financial and housing wealth are not directly affected by retirement; and the present value of the state (social security) pension in Britain is designed to be approximately invariant to the retirement age.[7]

A practical difficulty is imputing 1994 earnings, $e_{i94}$, for individuals for whom no earnings were observed in 1994. Imputation involved estimating earnings growth rates, $g_{i94}$, conditioned on a vector of explanatory variables observed in 1988/89, denoted by $h_{i88}$. By the properties of the lognormal distribution (treating this as a convenient approximation to the distribution of earnings),

$$g_{i94} = \ln e_{i94} - \ln e_{i88} = h_{i88}^T \beta + \omega_{i94} \tag{7}$$

$$\Rightarrow \quad \mathsf{E}(e_{i94}) = e_{i88}.\exp\left(h_{i88}^T \hat{\beta} + \hat{\sigma}_\omega^2/2\right), \tag{8}$$

where $\omega_{i94} \sim N\left(0, \sigma_\omega^2\right)$ is a stochastic disturbance and $\beta$ is a vector of coefficients.[8] In order to impute earnings as accurately as possible, a general-to-specific regression search was used to compute $\hat{\beta}$. The appendix contains details of the regression results. Results are also given for employees, which are used later for comparative purposes.

The bottom two rows of Table 1 disaggregate the accrual for retired and non-retired respondents. These data indicate that the accrual distribution for non-retirees

[7]To be sure, one can think of indirect effects on resources from deferral of retirement, e.g., if individuals move house when they retire, so that fluctuations in house prices become relevant. But most individuals do not move house at the same time as they retire. Similarly, businesses are not necessarily sold at the time of retirement and realised as an accrual, e.g., because some family businesses are bequeathed to successors. As noted above, only 4% of self-employed respondents in the RS held any net business wealth in any case.

[8]This imputation procedure enjoys an advantage over that of Meghir and Whitehouse (1997) by exploiting the 1988/89 wave of the RS, which was unavailable to those authors. Clearly, it is very problematic to impute 1994 earnings for those individuals without recorded earnings even in 1988/89, something we therefore do not attempt.

first order stochastically dominates that of retirees. Checks revealed that this is not merely an artefact of our imputation procedure, as very similar results were obtained when actual earnings of non-retirees in 1994 were replaced with their imputed values and comparisons were made with imputed earnings of retirees. Thus the different accrual values seem to reflect genuine differences in earnings opportunities.

## 3.3 Other explanatory variables

Several non-pecuniary variables, $x$, are likely to affect preferences for leisure relative to work, and thereby the probability of retirement, $\pi^*$. One such variable is age, which is expected to increase the marginal value of leisure, as the remaining time to enjoy it diminishes. On the other hand, cohort effects might confound this prediction, e.g., if older cohorts work harder than their younger counterparts. To allow for a non-linear effect in retirement-age patterns, the age data were represented by an orthogonal basis of degree two. The use of orthogonal polynomials is necessary because the limited range of the age data would result in strong collinearity if simply 'age' and 'age$^2$' were used. Therefore we transform the data onto orthogonal linear and quadratic scales. For our sample the transformations are

$$\begin{aligned} \psi_1(x) &= -0.8850 + 0.0133\,x \\ \psi_2(x) &= 5.3681 - 0.1650\,x + 0.0013\,x^2 \end{aligned} \tag{9}$$

which have the usual properties that

$$\begin{gathered} \sum_{i=1}^{n} \psi_1(x_i) = \sum_{i=1}^{n} \psi_2(x_i) = \sum_{i=1}^{n} \psi_1(x_i)\,\psi_2(x_i) = 0 \\ \sum_{i=1}^{n} \left\{\psi_1(x_i)\right\}^2 = \sum_{i=1}^{n} \left\{\psi_2(x_i)\right\}^2 = 1 \end{gathered} \tag{10}$$

when $x_i$ is the age of individual $i$ in the sample of size $n$.

An aspect of ageing that is of special interest in the present study is the bridge retirement process, whereby employees may choose self-employment as a 'stepping stone' to full retirement. We investigate this issue by checking whether the 'long term' self-employed have different retirement patterns compared with employees who switched into self-employment fairly recently. For this reason, a dummy variable for whether the individual was self-employed in the first wave of the RS (i.e., in 1988/89) is also included.[9] In our sample 57.9% were defined as long-term self-employed according to this definition.

A consideration that often arises when analysing behaviour of older workers is health. An individual's own poor health, or that of a relative they look after, might reduce their ability to run a business, and increase the value of spending time away from work. Poor health is measured using two variables. One is a weighted score (on a scale from 0 to 21) of 13 different disabilities relating to inability to undertake essential tasks, termed Activities of Daily Living (see Grundy and Glaser, 1997, for details). The second is a dummy variable for whether the individual is classified as disabled, where disability is defined as "any restriction or lack (resulting from an impairment) of ability to perform an activity in the manner or within the range considered normal for a human being."[10] In our sample 40% were classified as disabled, and the mean poor health score was 1.91.[11] A dummy variable is also defined for whether individuals care for a sick relative, since this might increase the relative disutility of work relative to leisure, the latter including time spent in the caring capacity. Carers comprised 5.6% of the sample.

Other relevant family-level variables are the number of children living in the household (the mean number in the sample was 2.31), and whether the individual was married (82.7% were). As above, these variables might be expected to increase the desire

[9] See also Blau (1994), who stresses the importance of job history variables. While work status six years previously might not give a precise idea of 'long term' work status in the 'conventional' (i.e., employee) sense, the low survival rates of small businesses suggests that this interpretation is not untenable for the self-employed. It will be seen below that this variable is indeed an informative discriminator among the self-employed.

[10] These health measures are based on self-assessed information. Self-reported health measures have been criticised in the literature because people can blame being out of the labour force on poor health (Parsons, 1982). But Bound (1991) points out that self-reported measures may be no worse than 'objective' measures.

[11] The relatively large number of disabled respondents might either reflect the more dangerous working conditions of the self-employed (as observed by OECD, 2000), or an institutional bias against employees with disabilities.

for leisure (retirement) relative to continued work. Finally, a family-level dummy variable that is expected to work in the other direction is whether the individual's spouse is working (see Blau, 1998). Although we do not explicitly consider issues of joint retirement in this paper,[12] if leisure is a joint household good, then having a working spouse might be expected to reduce the individual's surplus of post-retirement utility over pre-retirement utility, so decreasing the probability of retirement. In fact, it is unclear whether joint retirement should be more or less important for the self-employed relative to employees. On one hand, the self-employed have more variable incomes than employees do, and so can be expected to benefit more from household income smoothing derived from spousal income. Hence the retirement of a previously working spouse might yield an extra incentive for a self-employed person to retire, as the benefit from income smoothing is removed. On the other hand, if older self-employed workers are less well off on average than their employee counterparts (see below), then retirement of a spouse might make it all the more important that the self-employed person continues to work in order to safeguard household income.

Several other explanatory variables are also included in the econometric specification. One is a dummy for female gender (comprising 30% of the sample) which can be used to isolate any differences in preferences between the sexes in self-employed retirement behaviour. Two others were the number of years of schooling (the sample mean was 10.3), and a dummy variable for whether the individual had acquired vocational qualifications (19.3% of the sample had). Both of these variables might capture non-pecuniary aspects of jobs that make retirement relatively more or less attractive to continued work. So might social class, which is inferred in the RS from details about an individual's current or most recent occupation, narrowly defined. It is measured on an ordinal scale from 0 to 5, with 0 being the 'lowest' class. This was re-coded as five dummy variables to allow for the possibility of a non-monotonic or non-linear response to social class. In our sample 48.1% belonged to one of the top

[12] See, e.g., Hurd (1990), Zweimuller *et al* (1996), Gustman and Steinmeier (2000b) and Baker (2002). It seems justified not to model joint retirement explicitly in the present context because, as pointed out by Tanner (1997), *"the clear majority of couples* [in the RS] *do not retire at the same time."* (p. 48).

two social classes.

# 4 Estimation and Results

This section is divided into three parts. In the first, we estimate the static retirement equation (4), discuss the results, and compare them with those obtained for an employee sample taken from the RS. We also address issues of sample selection here. In the second part, we provide a dynamic analysis of retirement behaviour around the time of retirement, exploring the transitions between self-employment, employment, and retirement over the two waves of the RS. The third part contains a sensitivity analysis, to provide some checks on the robustness of the results.

## 4.1 Static analysis of retirement

We first estimated (4) by maximum likelihood. Table 2 contains the results for both broad (columns 1a and 1b) and narrow (columns 2a and 2b) definitions of retirement. All of the regressions presented in Table 2 are highly significant and data congruent, with good hit rates and insignificant Hosmer-Lemeshow statistics.[13]

Columns 1a and 2a measure both substitution (accrual) and income (accrual times lifetime wealth) effects. The latter are insignificantly different from zero, implying that $\lambda_1 \approx 0$. This suggests that the marginal utility of lifetime wealth is approximately constant for the self-employed, so that retirement and lifetime wealth are not strongly linked (see also Gustman and Steinmeier, 2001; and Blundell *et al*, 2002, for similar findings based on reduced form studies of employees). Imposing this restriction yields the results in columns 1b and 2b, in which the accrual now has a significant negative effect on retirement decisions. This result is in accordance with the life cycle model, implying that greater actual or potential earnings (the substitution effect) delay retirement. These findings are consistent with those of Meghir and

[13] All estimations were performed using LIMDEP 8.0, using robust standard errors derived from a sandwich-style covariance matrix estimator. See the notes to Table 2 and Greene (2002, 2003) for further details about these probit model performance measures.

Whitehouse (1997), who found using RS data that higher imputed earnings tend to delay job exits among employees.[14]

[INSERT TABLE 2 AROUND HERE]

Apart from the accrual, only two other explanatory variables are consistently significant for both definitions of retirement. One is age, which has a strong positive effect on retirement probabilities as expected, suggesting that the marginal utility of leisure relative to work increases as self-employed individuals get older. The other is long term self-employment status, suggesting that the long-term self-employed have a lower probability of retirement at every age. Two other explanatory variables are statistically significant using the narrower definition of retirement. These are age squared, which has a negative effect implying that the impact of age on retirement diminishes with age, and having a working spouse. The latter provides some limited support for the notion that retirement is a joint decision for couples.

Why do comparatively recent entrants to self-employment have a higher tendency to retire soon afterwards? One possibility is that some former employees purposefully choose self-employment as a bridge job, or form of partial retirement, as a stepping stone to full retirement (Quinn, 1980). Another possibility is that these employees are marginal or peripheral workers who are pushed into self-employment as a last resort. In an attempt to discriminate between these two explanations, we examined the detailed inter-wave job history files that accompany the RS. Table 3 presents summary statistics that distinguish between the 'long term' self-employed (i.e., who were self-employed in both waves), and the Wave 2 self-employees who were employees in Wave 1. We call the latter 'switchers'. The results suggest that switchers have a significantly and substantially greater incidence of part-time jobs and jobless spells between the waves than the long-term self-employed do. They also have significantly and substantially lower wealth and actual or potential earnings; are older on average; and have a higher unconditional probability of retirement. This suggests

[14] The reason for the significance of $\Omega_R$ once $\Omega_R\Omega$ is dropped is partly explained by the high correlation coefficient of 0.838 between the two variables. Therefore our preferred results are columns 1b and 2b, which remove this source of collinearity.

(tentatively given the relatively small sample sizes) that switchers have a relatively weak attachment to the labour market with less secure job matches, drifting in and out of temporary and part-time work of several kinds, including self-employment. While part-time work is not inconsistent with the notion of bridge jobs (Fuchs, 1982), the fact that switchers have so many more short-term jobs and are worse off than the long-term self-employed suggests that some 'push' factors are present too. Switchers certainly cannot be characterised as affluent employees who are voluntarily downsizing their jobs as a prelude to full retirement. In short, new self-employment jobs among older British workers seem to be less a form of partial retirement than a concerted effort by vulnerable workers to remain active in the workforce.

[INSERT TABLE 3 AROUND HERE]

There is also some weak evidence from Table 3 that switchers have somewhat worse health than the long term self-employed. They are also more likely to be female. But, as is evident from Table 2, neither health nor gender exerts a significant impact on the retirement decision in 1994 once long-term self-employment status is controlled for. This finding contrasts with previous evidence for employees.[15] It also contrasts with our own findings based on a sample of employees taken from the RS (the fact that this is also a relatively small sample might suggest that sample sizes are not driving the self-employed results). Table 4 replicates for our RS sample of employees the specifications reported in columns 1b and 2b of Table 2. The results from this exercise will be discussed more fully below; for now, it suffices to observe that among *employees*, females and those with worse health are significantly more likely to retire. For the self-employed, however, these results suggest that preferences are similar across genders, even while incentives differ (self-employed females have significantly lower accruals than self-employed males). Second, regarding health, it is possible that the self-employed are used to working when they are ill, as a consequence of their inability to access employer sick pay or sickness insurance schemes (Perry and

[15] For US evidence, see Burkhauser (1979), Gordon and Blinder (1980), Hogarth (1988), Berkovec and Stern (1991) and Samwick (1998). For UK evidence see Meghir and Whitehouse (1997). Siddiqui (1997) provides German evidence.

Rosen, 2004). And, the flexibility of self-employment might provide workers with ways of circumventing any physical limitations they face. Of course, these are only tentative hypotheses, and further research based on larger samples or more detailed case studies is needed to dig deeper into the underlying causes of the phenomenon. Nevertheless, it seems possible to conclude that institutional differences might explain why employee retirement behaviour is more sensitive to gender, health, and age.[16] Female employees have an earlier mandatory retirement age than males; early retirement schemes within corporations can enable employers to remove workers who take excessive sick leave; and there are binding mandatory retirement age limits. None of these provisions apply to the self-employed.

[INSERT TABLE 4 AROUND HERE]

Comparing columns 1b and 2b of Table 2 with columns 3 and 4 of Table 4 reveals other differences in the determinants of retirement between employed and self-employed Britons. Neither employment status in 1988/89 nor the accrual are significant for employees whereas they are for the self-employed.[17] And some aspects of family structure appear to matter more for employees than for the self-employed. In particular, the presence of children and a working spouse appear to decrease the likelihood that employees will retire, while these variables are less important for the self-employed.

Finally, we consider what the results so far tell us about why the self-employed retire later on average than employees do. The evidence points strongly to long-

[16] Note that the age-retirement relationship is approximately linear for employees, without a significant diminishing effect as was found for the self-employed in Table 2; and the size of the coefficients on linear age for employees are approximately double those estimated for the self-employed.

[17] Note, however, that the 'accrual' in Table 4 should really be regarded simply as actual or imputed earnings for employees. (They were calculated in the same way as for the self-employed – see the last columns of Table A1 in the appendix.) A true accrual for employees should also include the value of occupational rights conditional on the date of retirement (Blundell *et al*, 2002). Therefore the results in Table 4 afford an illustrative comparison only, and are certainly not intended as a definitive model of employee retirement – a task that goes beyond the scope of the present article (see Meghir and Whitehouse, 1997; Blundell *et al*, 2002; Bingley and Lanot, 2004). Even so, accrual values are higher for employees than for the self-employed: the absolute t-statistic for differences in $\ln(1+\Omega_R)$ between the two occupations is 6.239. Even allowing for income under-reporting by the self-employed of 30% (Pissarides and Weber, 1989) does not change this result, merely reducing the t-statistic to 4.675. As noted above, part of the reason for earlier retirement by employees no doubt reflects incentives for early retirement embodied in occupational pension schemes (Disney *et al*, 1994), which we do not attempt to quantify here.

term self-employment status as a central part of the answer. In particular, if we remove the long-term self-employed from the self-employed sample, the proportion of the self-employed 'switchers' from employment in 1988/89 who are retired under the broad definition is 83%: a very similar proportion to that of employees (see Table 3 and Section 3, respectively). In contrast, the proportion of long-term self-employed who are retired is only 50% (Table 3). This is where the root of the difference between paid employment and self-employment retirement rates seems to lie. It appears to have little to do with unobserved heterogeneity of the self-employed (sample selection), since estimation of (6) yielded $\hat{\rho} = 0.036$ (standard error = 3.063).[18] So while these findings cannot definitively exclude the possibility of unobservable heterogeneity, they certainly provide no support for the notion that people who select into self-employment are systematically different with respect to latent preferences for work relative to retirement.

## 4.2 Dynamic analysis of retirement

The two-wave nature of the RS makes it possible to analyse transitions between three labour market states: working in self-employment, working in paid employment, and being retired. An analysis of this issue is helpful because it sheds light on the dynamics of retirement, and puts the results for the self-employed into a broader perspective.

One can identify the factors that determine transitions between the two waves of the panel by generalising the binary choice model (5) into a three-state multinomial logit:

$$\Pr\left[s_{i94} = j\right] = \frac{\exp\{y_{i88}^T \delta_j\}}{\sum_{m=0}^{2} \exp\{y_{i88}^T \delta_m\}} \qquad j = 0, 1, 2\,, \tag{11}$$

[18]In estimating (6) by FIML, the $y$ variables used in the selection equation (5) include all of those used in (4), but measured at 1988/89 (rather than at 1994) values. Complete results are available from the authors on request.

where

$$s_{i94} := \begin{cases} 0 \quad \text{if} \quad i \quad \text{is retired by 1994} \\ 1 \quad \text{if} \quad i \quad \text{is working as an employee by 1994} \\ 2 \quad \text{if} \quad i \quad \text{is working as self-employed by 1994} \end{cases}$$

The $\delta_j$ are vectors of coefficients for each employment group $j$, and $y_{i88}$ is a vector of explanatory variables observed in 1988/89. Following conventional practice, we identify the parameters of this model by imposing the vector normalisation $\delta_0 = 0$.

Table 5 presents the matrix of transitions between each employment group.[19] It shows that the largest number of transitions is from any kind of work to retirement. One quarter of the working self-employed in 1994 came from retirement or paid employment in 1988/89, while there were very few transitions from self-employment to paid employment between the waves. However, only 3.6% [=12/331] of working employees in 1988/89 who continued to work in 1994 switched to self-employment over the 5 year interval — a lower switching rate than reported in previous US studies.[20] Detailed examination of the job history files identified a further 24 employees in Wave 1 who tried self-employment at some time between the two waves but who were retired by 1994. Thus while there is some evidence of transitions between employment groups generally, and into self-employment specifically, the numbers involved appear to be fairly modest.

[INSERT TABLES 5 & 6 AROUND HERE]

To explore the matter further, we estimated (11) using data from both waves of the RS. We utilised a similar specification to that used elsewhere in the paper, apart from excluding a working spouse variable (unavailable in 1988/89), and including dummies for employment status in Wave 1. The results appear in Table 6. Even after controlling for observable characteristics, most of the explanatory power comes from strong persistence in occupational choices. Interestingly, Table 6 indicates a

[19] One could also look at transitions into and out of unemployment, but the sample sizes are not large enough to enable a robust analysis to be performed.

[20] Fuchs (1982) and Bruce *et al* (2000) each reported a *two-year* switching rate of 4%.

negative effect from poor health on participation in self-employment (but not paid employment), suggesting that unhealthy respondents in Wave 1 prefer to retire than to switch into self-employment later in life. In contrast, as we found earlier, poor health does not appear to hasten retirement among those who have already chosen self-employment.

### 4.3 Sensitivity analysis

It is desirable to check the robustness of our results. We did so in several ways. First, we tried an alternative specification of the retirement probit in which the interaction term $\Omega_R\Omega$ was replaced by $\Omega$, thereby conditioning $\pi_i^*$ on $\Omega_R$ and $\Omega$ separately (as in, e.g., Blundell *et al*, 2002). The results were very similar to those reported in Table 2, with the coefficient on $\Omega$ still being statistically insignificant.

Second, we checked the sensitivity of our results to different accrual imputation methods. For example, we applied a common (average) self-employment earnings-growth rate to all respondents with observed Wave 1 earnings but no Wave 2 earnings, instead of the individual-specific earnings growth rates estimated in the appendix. Results were qualitatively the same as those in Table 2.

Third, we checked whether the quadratic effects of age on self-employed retirement behaviour captured any peaks in the data at ages 60 and 65 (the female and male mandatory retirement ages for employees in Britain). No effects were found when two dummies were included: a Wald test statistic of $\chi^2(2) = 1.49$ was unable to reject the null hypothesis of insignificance. We also checked for outliers and identified seven observations with especially large accrual values, but removing them did not change the results in any noticeable way.

Fourth, we asked whether pooling self-employed and employee observations, makes any difference to the results. We investigated this question by interacting all variables and the constant term with a dummy for 'self-employment status'. This did not change any of the findings. A joint test of significant differences between the two occupational groups was upheld: a Wald test statistic of $\chi^2(18) = 68.82$ rejected the null hypothesis of a common specification.

Finally, we checked whether an intercept dummy was sufficient to capture gender differences in self-employed retirement behaviour. We did so by testing the explanatory power of a full set of gender and variable interaction terms. A Wald statistic of $\chi^2(17) = 16.83$ failed to reject the null hypothesis that separate specifications are unnecessary.

# 5 Policy discussion

Why might a better understanding of self-employment retirement behaviour matter to policy makers? In this section, we shall briefly address this question, on the working assumption that the government seeks to encourage labour force participation among older workers, while also seeking to promote self-employment separately as part of a general pro-enterprise stance.

One possible reason for the policy relevance of this research is that average retirement ages are substantially higher in self-employment than in paid employment, implying that encouraging older retired or unemployed employees to become self-employed could stimulate greater aggregate labour force participation. Second, knowing why some individuals choose to become self-employed in later life might also assist policy-makers in determining the appropriate structure of any self-employment or business start-up scheme targeted at older workers. An important related issue is the duration of job spells among those switching into self-employment in later life. In addition, governments might be interested in discovering whether, once workers are self-employed, there is anything they can do to keep them working there rather than retiring — again, as part of a labour force participation policy.

Regarding appropriate forms of policy intervention, it is important to bear in mind the results from our dynamic analysis which illustrated the persistence of occupational and participation choices in later life. Specifically, it would seem that a policy of encouraging older workers to become self-employed is unlikely to be successful. More generally, safeguarding workers' health appears to be an important aspect of keeping more people in work. Interestingly, the mechanisms appear to be different for employees and the self-employed. For employees, poor health increases the probability of retirement. While we could not find a similar effect for the self-employed, we saw that individuals in poor health are significantly less likely to choose a spell of self-employment in later life. Therefore advances in health-care that help keep older workers active appear to be a key aspect of any government initiatives to promote labour force participation and self-employment among older workers.

When we look at the characteristics of those employees who switch into self-employment in later life, other policy implications emerge. Only a limited number of older working employees switch into self-employment. Of those that do, few of them fall into the category of affluent workers using it as a bridge job to make a gentle transition to full retirement; most are peripheral workers with limited financial means who are engaged in a succession of short term and often part time jobs. If blanket policies were to be devised to make it easier for employees to become self-employed, our results suggest that these types of worker are the most likely to take up the policy. Unfortunately, relatively few of them end up creating long-lived businesses, being much more likely to retire than are established business owners who have been self-employed for a long time. Therefore it is not clear what would be gained by a policy that encouraged such workers to enter self-employment – a point that has added force as peripheral workers have also been identified as the most difficult to assist in unemployment-to-self-employment start-up programmes (Bendick and Egan, 1987). A more promising route might be job skill programmes and managerial training programmes dedicated to self-employed workers specifically (Devaney and Kim, 2003). And longer-term self-employment policies also look promising, as workers who persist with self-employment have the lowest average retirement rates of all workers.

Another class of policy interventions might seek to operate on the margin of keeping self-employed individuals in work rather than retiring. Any policies of this kind need to recognise that the self-employed exhibit different retirement behaviour than employees, although our findings are necessarily tentative given the relatively small size (197) of our sample. Because higher earnings around retirement seem to deter retirement by the self-employed, maintaining or cutting current levels of income tax might help sustain continued workforce participation by these individuals. But our results furnish few other concrete suggestions for policies that would also work towards this end.

## 6 Conclusion



Several findings emerge from this enquiry into the retirement behaviour of British self-employed workers based on *Retirement Survey* (RS) data. First, estimation of a simple life-cycle model identified a few significant determinants of self-employed retirement behaviour. Specifically, higher earnings around retirement decrease the probability of retirement, while age increases it. Also, self-employed individuals who were self-employed six years previously (the 'long term' self-employed) are significantly less likely to retire than those who were not. The 'switchers' into self-employment in later life do not resemble affluent employees downsizing to enjoy a gentle transition to full retirement. Instead, they tend to be marginal workers with unstable job histories and limited means, some of whom apparently turn to self-employment as a last resort before finally retiring. Retirement rates were found to be similar for switchers and employees who retired instead. The main difference between the self-employed and employees is therefore between the long term self-employed and employees. Our success in finding some significant determinants of self-employed retirement behaviour is reassuring in view of the well-documented heterogeneity of the self-employed, and the inability of researchers to explain other aspects of their labour supply behaviour (Rees and Shah, 1994).

Second, several variables that might have been expected to affect self-employed retirement propensities turned out to be statistically insignificant. These include poor health and gender, which both significantly affect employee retirement behaviour. Although the small self-employed sample size used here might explain this result, other explanations grounded in institutional differences are also tenable. These include mandatory employee retirement ages that come earlier for females than for males, and government- and employer-provided sickness benefits. None of these provisions apply to the self-employed.

Third, our dynamic analysis identified only a limited number of transitions between different labour market states among older workers, with persistence in retirement, paid employment and self-employment being the norm. A greater proportion of older employees made a transition to self-employment than the other way round, but this amounted to only 3.6% of all older employees over a 5 year time horizon. We also found that while poor health does not affect the retirement behaviour of older self-employed workers directly, it does significantly decrease the probability that workers will move into this kind of work.

The policy implications of our findings can be summarised as follows. First, the scope for government to encourage greater labour force participation among older workers by promoting self-employment as a vehicle may be quite limited. The persistence of employment choices in later life, and the finding that only the long-term self-employed retire significantly later than employees do, are the reasons for caution in this regard. Second, policies to promote better health among older workers are likely to affect the self-employed mainly by operating on the occupational choice margin, whereas for employees the policy would mainly work by postponing retirement.

Clearly, much remains to be done to refine the analysis and the policy recommendations advanced here, and to dig more deeply into the nature of employment transitions in later life. The availability of more high quality longitudinal data — such as the new English Longitudinal Survey of Ageing[21] — will be an integral part of this research agenda.

[21] See http://www.data-archive.ac.uk/findingData/snDescription.asp?sn=5050

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Table 1. Summary statistics of lifetime wealth and the accrual

| | Non-zero (%) | Quantiles | | | | |
|---|---|---|---|---|---|---|
| | | min. | 25% | Median | 75% | max. |
| *Sources of wealth* § | | | | | | |
| Housing (35.59 %) | 84 | 0 | 31939 | 37297 | 71651 | 250674 |
| Financial non-housing (17.29 %) | 86 | 0 | 954 | 6937 | 24520 | 185024 |
| State pension (18.35 %) | 93 | 0 | 20007 | 26163 | 29963 | 91924 |
| Private pension (6.83 %) | 39 | 0 | 0 | 0 | 10380 | 167214 |
| Occupational pension (7.65 %) | 32 | 0 | 0 | 0 | 8714 | 178486 |
| Earnings (13.61 %) | 54 | 0 | 0 | 1011 | 18556 | 543904 |
| Business (0.68 %) | 4 | 0 | 0 | 0 | 0 | 108062 |
| Lifetime, $\Omega$ | 100 | 15547 | 76871 | 115240 | 193788 | 865124 |
| *Accrual,* $\Omega_R$ | | | | | | |
| Non-retired † | 65 | 0 | 2947 | 8450 | 16426 | 123500 |
| Retired | 97 | 0 | 130 | 1752 | 7808 | 30790 |

Notes:
Sample size: 197. Authors' calculations from Retirement Survey data. All values expressed in £, net of tax, 1994 prices.

§. Average percentages of lifetime wealth in parentheses.
†. Broad definition of retirement.

*Table 2. Determinants of self-employed retirement probabilities*

| | Broad ret. definition | | Narrow ret.definition . | |
|---|---|---|---|---|
| | **(1a)** | **(1b)** | **(2a)** | **(2b)** |
| Constant | 2.096 * | 2.160 * | 2.503 * | 2.622 ** |
| | (1.003) | (1.015) | (1.038) | (1.048) |
| No. Children | 0.020 | 0.016 | 0.047 | 0.048 |
| | (0.078) | (0.077) | (0.080) | (0.080) |
| Disabled | 0.067 | 0.071 | -0.321 | -0.318 |
| | (0.282) | (0.283) | (0.298) | (0.302) |
| Married | -0.019 | -0.006 | 0.045 | 0.074 |
| | (0.349) | (0.347) | (0.335) | (0.331) |
| Linear age | 12.482 ** | 12.345 ** | 14.424 ** | 14.339 ** |
| | (3.023) | (2.947) | (3.212) | (3.143) |
| Quadratic age | -4.920 | -4.979 | -6.086 * | -6.078 * |
| | (2.932) | (2.881) | (2.695) | (2.647) |
| Social class, s s=1 | 0.625 | 0.624 | 0.607 | 0.595 |
| | (0.662) | (0.661) | (0.679) | (0.677) |
| s=2 | 0.101 | 0.114 | -0.211 | -0.197 |
| | (0.628) | (0.627) | (0.645) | (0.645) |
| s=3 | 0.701 | 0.722 | 0.901 | 0.934 |
| | (0.677) | (0.679) | (0.706) | (0.710) |
| s=4 | 0.570 | 0.586 | 0.390 | 0.388 |
| | (0.620) | (0.618) | (0.634) | (0.631) |
| s=5 | 0.609 | 0.602 | -0.007 | -0.012 |
| | (0.711) | (0.712) | (0.727) | (0.728) |
| Poor health score | 0.010 | 0.010 | 0.027 | 0.025 |
| | (0.035) | (0.035) | (0.037) | (0.036) |
| Long-term self-emp | -0.809 ** | -0.799 ** | -0.906 ** | -0.895 ** |
| | (0.266) | (0.262) | (0.277) | (0.275) |
| Female | -0.005 | -0.027 | 0.044 | 0.023 |
| | (0.306) | (0.303) | (0.293) | (0.287) |
| Cares for sick relative | 0.459 | 0.459 | 0.712 | 0.731 |
| | (0.459) | (0.462) | (0.481) | (0.492) |
| Spouse works | -0.432 | -0.437 | -0.636 * | -0.655 * |
| | (0.289) | (0.290) | (0.286) | (0.286) |
| Vocational Quals. | 0.115 | 0.107 | -0.091 | -0.121 |
| | (0.292) | (0.295) | (0.282) | (0.277) |
| Years education | -0.052 | -0.056 | -0.059 | -0.070 |
| | (0.064) | (0.065) | (0.068) | (0.069) |
| Accrual | -1.637 | -2.430 * | -0.932 | -2.702 * |
| | (2.720) | (1.083) | (3.273) | (1.333) |
| Accrual * Lifetime wealth | -0.285 | | -0.886 | |
| | (1.120) | | (1.653) | |

| | | | | | |
|---|---|---|---|---|---|
| – log likelihood | | 85.684 | 85.763 | 82.534 | 82.804 |
| Overall significance | | 87.296 ** | 85.115 ** | 101.780 ** | 100.177 ** |
| Hit rate (%) | | 77.665 | 78.680 | 79.695 | 78.680 |
| Hosmer-Lemeshow $\chi^2$ (6) | | 6.422 | 5.952 | 3.756 | 4.936 |
| Fit: | Estrella | 0.413 | 0.410 | 0.478 | 0.474 |
| | $R^2$ - ML | 0.354 | 0.352 | 0.403 | 0.400 |

Notes:
Sample size: 197 for all regressions.

All variables are defined in the text, with Accrual and Lifetime Wealth each expressed in hundreds of thousands of pounds.

Standard errors in parentheses, obtained using a sandwich style robust covariance estimator.

* Indicates significance at 5%; ** indicates significance at 1%. Overall significance is a $\chi^2$ test of the joint significance of the coefficients; degrees of freedom are 19 in columns 1a and 1b and 18 in columns 2a and 2b. Hit rate is the proportion of correct predictions, using a 50 per cent cut-off rule. The Hosmer-Lemeshow statistic evaluates divergence between actual and predicted values: a significant value indicates a large divergence. Estrella and $R^2$-ML are "$R^2$"-type goodness of fit statistics.

Table 3. Characteristics of the self-employed sample in 1994 disaggregated by job history: mean values

| | **Employees in wave 1** | **"Long term" self-employed** | **P value** |
|---|---|---|---|
| *Discrete variables* | | | |
| *Retired (Broad)* | *0.831* | *0.500* | *0.000 ***** |
| (Narrow) | 0.807 | 0.430 | 0.000 ** |
| Married | 0.819 | 0.833 | 0.797 |
| Disabled | 0.470 | 0.351 | 0.093 |
| Female | 0.398 | 0.237 | 0.016 * |
| Spouse works | 0.253 | 0.193 | 0.316 |
| Vocational Quals. | 0.181 | 0.202 | 0.711 |
| Cares for sick relative | 0.050 | 0.060 | 0.688 |
| *Continuous variables* | | | |
| Age | 67.868 | 65.325 | 0.001 ** |
| Poor health score | 2.465 | 1.513 | 0.086 |
| $\ln(\Omega)$ | 11.394 | 11.802 | 0.000 ** |
| $\ln(1+\Omega_R)$ | 4.984 | 7.735 | 0.000 ** |
| Social class scale | 2.880 | 3.053 | 0.373 |
| Years education | 10.096 | 10.518 | 0.137 |
| No. Children | 2.241 | 2.368 | 0.567 |
| Job history variables | | | |
| No. jobs between waves | 0.470 | 0.096 | 0.000 ** |
| part-time | 0.337 | 0.044 | 0.000 ** |
| full-time | 0.133 | 0.053 | 0.187 |
| No. jobless spells between waves | 0.386 | 0.018 | 0.000 ** |
| Sample size | 83 | 114 | |

Notes:
Variables defined in the text. For asterisks, see Table 2.

Statistical tests: For continuous and job history variables, p-values are based on t-tests which are robust to unequal variances. For discrete variables, p-values are based on likelihood ratio $\chi^2$ tests.

Source: The Retirement Survey.

*Table 4. Determinants of employee retirement probabilities*

| | Broad ret. definition (3) | Narrow ret.definition . (4) |
|---|---|---|
| Constant | 0.474 | 0.382 |
| | (0.426) | (0.413) |
| No. Children | -0.082 * | -0.068 |
| | (0.041) | (0.040) |
| Disabled | 0.109 | 0.153 |
| | (0.161) | (0.160) |
| Married | 0.234 | 0.198 |
| | (0.159) | (0.154) |
| Linear age | 29.965 ** | 22.157 ** |
| | (5.291) | (4.534) |
| Quadratic age | -1.402 | -5.733 |
| | (5.127) | (5.164) |
| Social class, s s=1 | -0.295 | -0.336 |
| | (0.246) | (0.238) |
| s=2 | -0.146 | -0.172 |
| | (0.234) | (0.230) |
| s=3 | 0.093 | -0.052 |
| | (0.241) | (0.234) |
| s=4 | 0.226 | 0.082 |
| | (0.241) | (0.236) |
| s=5 | 0.177 | 0.242 |
| | (0.383) | (0.377) |
| Poor health score | 0.061 * | 0.062 * |
| | (0.027) | (0.026) |
| Long-term self-emp | -0.018 | -0.114 |
| | (0.227) | (0.206) |
| Female | 0.392 ** | 0.376 ** |
| | (0.145) | (0.140) |
| Cares for sick relative | 0.228 | 0.260 |
| | (0.262) | (0.254) |
| Spouse works | -0.552 ** | -0.564 ** |
| | (0.143) | (0.142) |
| Vocational Quals. | -0.083 | -0.021 |
| | (0.166) | (0.162) |
| Years education | 0.0001 | 0.003 |
| | (0.034) | (0.033) |
| Accrual | 2.040 | 0.885 |
| | (1.219) | (1.241) |

| | | | |
|---|---|---|---|
| – log likelihood | | 301.341 | 316.137 |
| Overall significance | | 162.372 ** | 144.177 ** |
| Hit rate (%) | | 76.963 | 73.997 |
| Hosmer-Lemeshow $\chi^2$ (8) | | 9.638 | 10.476 |
| Fit: | Estrella | 0.273 | 0.243 |
| | $R^2$ - ML | 0.247 | 0.222 |

Notes:
Source: The Retirement Survey. Sample size: 573 for both regressions.

*Table 5. Transition matrix of employment status*

| Employment group | Retired in 1994 | Working employee in 1994 | Working self-employed in 1994 | Total number, 1988/89 |
|---|---|---|---|---|
| **Retired in 1988/89** | 1393 | 41 | 7 | 1441 |
| **Working employee in 1988/89** | 643 | 319 | 12 | 974 |
| **Working self-employed in 1988/89** | 73 | 4 | 57 | 134 |
| **Total number, 1994** | 2109 | 304 | 76 | 2549 |

Notes:
Source: The Retirement Survey, 1994.

The sample size of 76 working self-employed exceeds the 71 used in the estimation of (4) and (6), as 5 observations had to be dropped in those estimations owing to missing data on explanatory variables.

*Table 6. Multinomial logit analysis of dynamic retirement and employment decisions*

| | Working as an employee by 1994 | Working as self-employed by 1994 |
|---|---|---|
| *Dummy for* | | |
| retired in 1988/89 | -1.640 ** | -3.779 ** |
| | (0.343) | (0.869) |
| employee in 1988/89 | -0.049 | -3.128 ** |
| | (0.337) | (0.626) |
| No. Children | -0.009 | -0.025 |
| | (0.031) | (0.028) |
| Disabled | -0.216 | 0.957 |
| | (0.242) | (0.624) |
| Married | -0.247 | -0.310 |
| | (0.197) | (0.424) |
| Linear age | -71.146 ** | -60.597 ** |
| | (11.045) | (18.986) |
| Quadratic age | -9.369 | -6.415 |
| | (11.736) | (12.175) |
| Social class, s s=1 | -0.367 | -0.896 |
| | (0.271) | (0.948) |
| s=2 | -0.148 | 0.010 |
| | (0.267) | (0.826) |
| s=3 | -0.393 | -0.016 |
| | (0.276) | (0.869) |
| s=4 | -0.406 | -0.494 |
| | (0.294) | (0.826) |
| s=5 | -0.525 | 0.229 |
| | (0.502) | (1.108) |
| Poor health score | -0.008 | -0.470 ** |
| | (0.040) | (0.169) |
| Female | -0.245 | -0.255 |
| | (0.205) | (0.552) |
| Cares for sick relative | 0.008 | 0.053 |
| | (0.107) | (0.399) |
| Vocational Quals. | -0.131 | 0.332 |
| | (0.181) | (0.395) |
| Years education | -0.108 ** | -0.090 |
| | (0.032) | (0.072) |

| | |
|---|---|
| – log likelihood | 716.573 |
| Overall significance | 753.930 ** |
| Hit rate (%) | 85.833 |
| Pseudo-$R^2$ | 0.345 |

Notes:
Sample size: 2047. Robust standard errors appear in parentheses. The coefficients are log-odds ratios of being an employee or self-employed relative to retired in 1994.

All explanatory variables take 1988/89 values.

## *Appendix*

Table A1. Earnings growth regressions used for imputing accrual values

| | **Self-employed** | | **Employees** | |
|---|---|---|---|---|
| | **Coefficient** | **St. error** | **Coefficient** | **St. error** |
| Constant | 5.640 * | 2.373 | | |
| Social class | -0.178 * | 0.083 | | |
| Mixed job history | 0.966 ** | 0.284 | | |
| Work hours | 0.019 ** | 0.007 | | |
| *Log earnings* | *-0.637 ***| *0.129* | *-0.403 ***| *0.074* |
| Linear age | -0.064 | 0.038 | 0.171 ** | 0.029 |
| Quadratic age | | | -0.002 ** | 0.000 |
| Female | | | -0.310 * | 0.155 |
| Years education | | | -0.078 * | 0.039 |
| Resides in South East | | | 0.345 * | 0.139 |
| Sample size | 61 | | 208 | |
| $\sigma^2_\omega$ | 0.763 | | 0.884 | |
| $R^2$ | 0.441 | | 0.270 | |
| Overall significance: F | 8.834 ** | | 7.789 ** | |

Notes:

All explanatory variables measured at 1988/89 (Wave 1). *Social class* is that of the most recent job; *Mixed job history* is a dummy variable taking the value 1 if the individual has had a job history with a mixture of paid employment and self-employment, and 0 otherwise; and *Resides in the South East* and *Female* are also dummy variables.

For asterisks, see notes to Table 2.